HEWLETT PACKARD

43130A DEFIBRILLATOR

PART NUMBER 43130-91909

MICROFICHE NUMBER 43130-90999

Sixth Edition

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5/91

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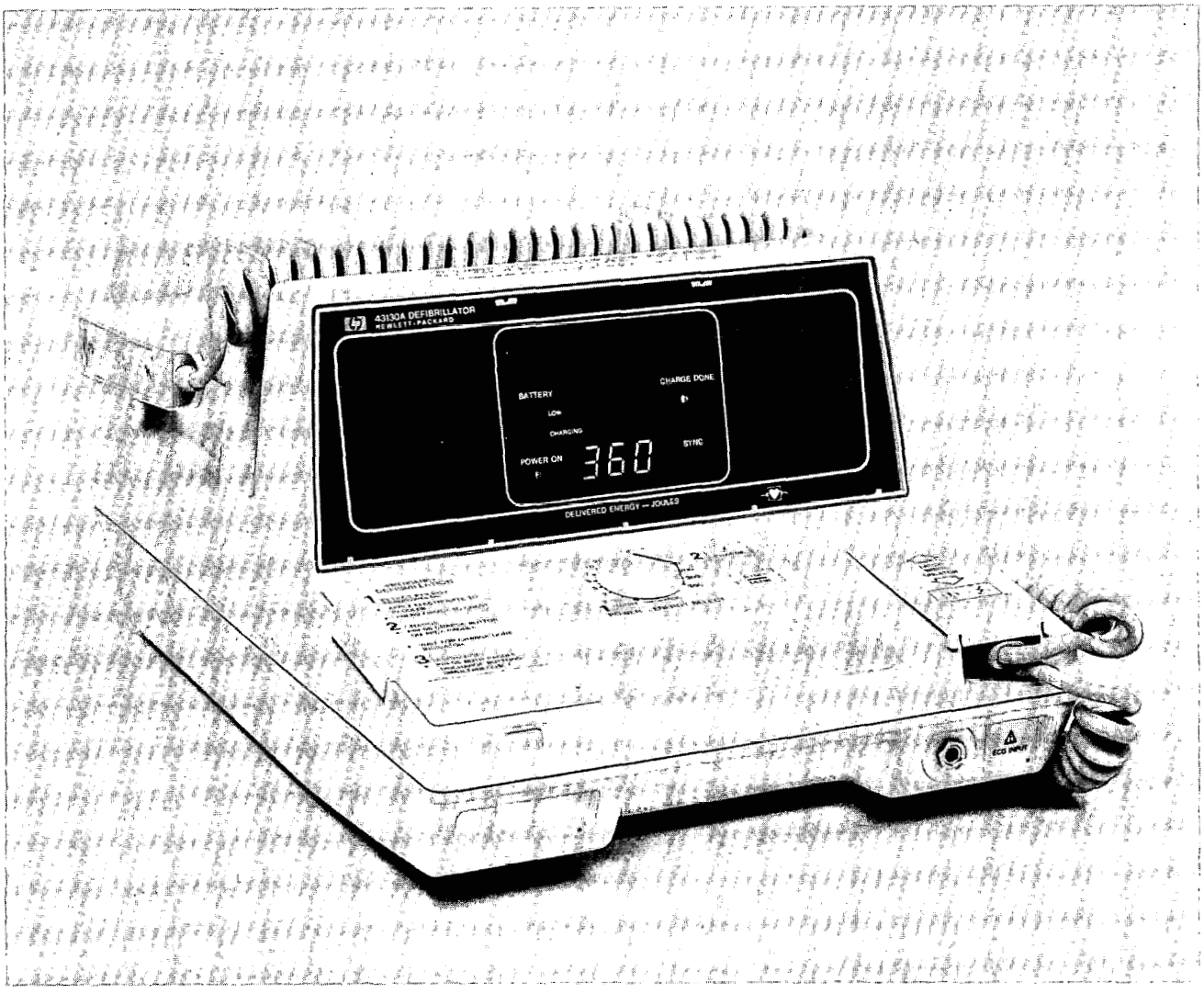
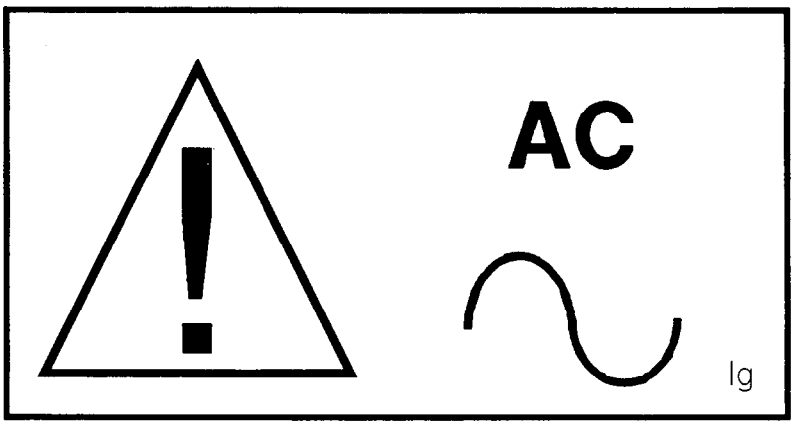
43130A DEFIBRILLATOR



OPERATING GUIDE



ADDENDUM
EMERGENCY BACKUP OPERATION

Defibrillators with this label have emergency A C power backup capability. This allows limited operation under most battery failed conditions, as long as the defibrillator is connected to the A C power line. The defibrillator will also operate if the battery is removed and the instrument is connected to the A C power line.

When operating the instrument in this mode some performance differences will be observed:

1. The time to charge the defibrillator to the maximum energy level (360 joules) will be approximately 20 to 30 seconds. Normal charge time with a fully charged battery is less than ten seconds.

2. During defibrillator charging, flickering of the CRT display will be evident.

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43130A DEFIBRILLATOR

OPERATING GUIDE

43130-91908

DO: Read the OPERATING GUIDE before operating the instrument

Exercise CAUTION when using the instrument

Keep a battery installed in the instrument at all times

Keep the battery charging during standby periods

Recharge the battery when "LOW BATTERY" condition occurs

DON'T: Open the instrument case

Use the defibrillator in a flammable atmosphere

Allow excess electrolyte paste or gel to accumulate

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INTRODUCTION

This Operating Guide provides installation, operational, and basic maintenance instructions for the safe use and proper care of the Hewlett-Packard Model 43130A Defibrillator. BEFORE USING THE INSTRUMENT, READ THIS MANUAL AND BECOME THOROUGHLY FAMILIAR WITH ITS CONTENTS .

SAFETY CONSIDERATIONS

The HP 43130A stores high voltage energy and is capable of delivering up to 360 joules of DC energy to a 50 ohm impedance. Disconnecting the Model 43130A from an AC outlet will not remove power; the instrument is battery-powered, meaning that the ENERGY SELECT control must also be placed in the OFF position. In order to disarm a charged unit, turn the ENERGY SELECT control to the ON or OFF positions, or place the paddles in their holders and depress both DISCHARGE buttons. As a safety feature, the HP 43130A is designed to automatically discharge internally if it has been left charged for more than 60 seconds.

The HP 43130A is designed with all-plastic handles and controls to minimize shock hazard. When not plugged into an AC line, it is a battery-powered instrument with no reference to earth ground, and small static charges may be generated during defibrillator discharges. These static charges present a minor shock potential to the operator, but ONLY through the exposed metal surfaces. Avoid touching these surfaces during defibrillator discharge.

Medical electronic equipment which may not incorporate defibrillation protection, e.g., blood flow meters, should be disconnected from the patient during defibrillation discharge.

Never touch the bed, the patient, or any equipment connected to the patient (e.g., patient leads) during defibrillation. Fluids such as Ringer's saline solution and blood are excellent electrical conductors; to avoid creating potentially dangerous electrical paths, keep the 43130A and the immediate area clean and dry at all times.

NEVER open the instrument case; there are no operator controls inside and dangerous high voltages may be exposed. Refer servicing to qualified service personnel.

1 GENERAL INFORMATION

DO NOT use the defibrillator in a flammable atmosphere (i.e. oxygen tents or other areas of concentrated flammable anesthetics). Avoid using portable or emergency vehicle-mounted defibrillators immediately near the site of an automobile wreck - spilled gasoline and puddles of water present extremely dangerous explosion and shock hazards. Contact your local He wlett-Packard sales or service engineer when any unanswered questions arise concerning safe operation of the HP Defibrillator.

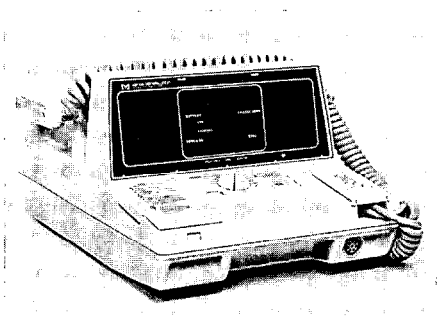
ABOUT THE HP 43130A DEFIBRILLATOR

Your Hewlett-Packard 43130A is a DC defibrillator only, it does not contain its own ECG monitor or strip chart recorder. ECG input for synchronized cardioversion must be provided from an external monitoring system. Energy is selectable from 2 to 360 joules (calibrated for 50 ohms impedance) in 14 discrete steps.

The HP 43130A operates from either AC line power or the integrated rechargeable battery. The fully charged battery is capable of providing fifty 360 joule discharges. An indicator on the front panel lights when the defibrillator is connected to AC power and the battery is charging. A second indicator will light indicating a "LOW BATTERY".

WARNING: PACEMAKER PATIENTS. Rate meters may continue to count the pacemaker rates during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker patients under close surveilance.

The compact, lightweight instrument design, along with battery operation, permit use of the defibrillator in portable applications. The optional accessories pouch provides convenient storage for Redux® paste or defibrillator pads.



Model 43130A

SELF DIAGNOSTICS

The HP 43130A Defibrillator uses microprocessor technology to control and monitor system operation. This advanced design enables the unit to perform a self-diagnostic routine.

Critical circuits within the unit's defibrillator section are monitored and checked periodically during operation. Each time the instrument power is turned ON, proper operation of these circuits is verified and the DELIVERED ENERGY display will briefly flash "HP" and "888". Should a problem be detected, an appropriate ERROR message will be generated on the digital display. The defibrillator should immediately be turned OFF and service personnel notified should an ERROR condition arise.

DEFIBRILLATOR CHARGE TIME

The defibrillator will charge to 360 joules in less than 10 seconds, when powered from a fully charged battery. After several full energy discharges on battery power, the charge time may become slightly longer.

OPERATING ENVIRONMENT

The location of your HP 43130A should be reasonably free from vibration, dust, corrosive or explosive vapors or gases, extreme temperature, and excessive humidity. The operating environment limits for the HP 43130A, including all options, are:

Temperature: 0° C to 55° C
Relative Humidity: 5% to 95%
Altitude: 4,600 m maximum

The instrument may exhibit decreased useable battery capacity (i.e. less than 2.5 hours monitoring time available from a fully charged battery) when operated outside these temperature limits. This condition will only be seen during use outside of the listed temperature limits; normal battery performance will resume when returned to standard operating temperatures.

Temperature while charging battery: +15° C to +35° C

The battery may not reach 100% full charge (using either direct AC power or the Model 43190A or 43192A Power Converters) if charged at temperatures below +15° C. If charged repeatedly at temperatures exceeding +15° C. If charged repeatedly at temperatures exceeding +35° C, the useful life of the battery will be limited.

1 GENERAL INFORMATION

NOTE: As with all electronic equipment, radio frequency interference between the defibrillator or power converter and any existing radio transmitting or receiving equipment at the installation site or in a vehicle, should be evaluated carefully and any limitations noted before the equipment is placed in service. Hewlett-Packard assumes no liability for failures resulting from RF interference between HP medical electronics and any radio frequency generating equipment.

STORAGE AND SHIPMENT ENVIRONMENT

The storage and shipping environment limits for the 43130A, including all options, are:

Temperature: -40° C to 75° C
Relative Humidity: 5% to 95% (40° C)
Altitude: 15,300 m maximum.

SPECIFICATIONS

DEFIBRILLATOR

Waveform: Lown Waveform (Damped sinusoidal).

Output Energy (delivered): 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 150, 200, 300, and 360 joules.

Charge Control: Push-button on APEX paddle and on front panel.

Charge Time: Less than 10 seconds to 360 joules when powered by a fully charged battery.

Delivered Energy Display: digital display indicates energy which will be delivered into 50 ohms impedance.

Armed Indicators: Charge done tone, charge done lamp on apex paddle, and delivered energy display.

Safety Interlock: Output energy limited to 50 joules when internal paddles are installed.

Paddles: Standard paddles are anterior/anterior, adult and pediatric. Adult electrodes slide off to expose pediatric electrodes. Full range of anterior/posterior and internal paddles are available.

Synchronizer: SYNC indicator on front panel lights while in synchronous mode. There is an audible beep with each detected R-wave, while a marker pulse on the monitor indicates discharge point. Upon activation, discharge occurs within 30ms of marker pulse.

SIZE AND WEIGHT

Dimensions: 21.5 cm H x 29.8 cm W x 43.2 cm L (8.4″ x 11.7″ x 17″)

Weight: 9 kg (20 lb.)

BATTERIES

Type: 2.5 Ampere-hour rechargeable starved electrolyte sealed lead acid.

Charge Time: 2 hours for 90% capacity (from depleted state).

Capacity: Fifty (50) full energy (360 joule) discharges.

Charging Indicator: An LED on the front panel lights when the battery is charging. A second LED indicates limited available battery capacity.
Maximum Power Consumption: 100 VA

STANDARD ACCESORIES

Redux® Paste, 5 oz., part number 651-1008

SYNC Cable, part number 8120-1022

Operating Manual

Operating Instruction Card

ORDERING INFORMATION

OPTIONS

C02 Add 6.0 cm Internal Paddle Set. Includes handle set, part number 14990B, and 6.0 cm diameter electrode set, part number 14995A.

C03 Add Anterior/Posterior Paddle Set. Includes paddle set, part number 14412D.

C04 Add 7.5 cm Internal Paddle Set. Includes handle set, part number 14990B, and 7.5 cm diameter adult electrode set, part number 14993A.

C05 Add 4.5 cm Internal Paddle Set. Includes handle set, part number 14990B, and 4.5 cm diameter pediatric electrode set, part number 14992A.

C06 Add 2.8 cm Internal Paddle Set. Includes handle set, part number 14990B, and 2.8 cm diameter infant electrode set, part number 14994A.

C07 Technical Documentation Option; includes HP 43130A Service Manual, part number 43130-91909.

C09 Delete Anterior/Anterior Paddle Set.

J02 IEC Lead Set.

K01 Add Accessories Pouch, P/N 43100-69500.

K02 Defibrillator Carrying Case.

L01 French Language

L02 German Language

L03 Dutch Language

L04 Spanish Language

L05 Italian Language

L06 Swedish Language

N01 CSA Approval

N02 IEC/VDE Approval

N05 NEMKO Approval

Z01 50Hz Power

Z02 100V Power

Z05 230V Power

900 UK Power Cord

901 Australian Power Cord

902 European Power Cord

906 Swiss Power Cord

917 South Africa Power Cord

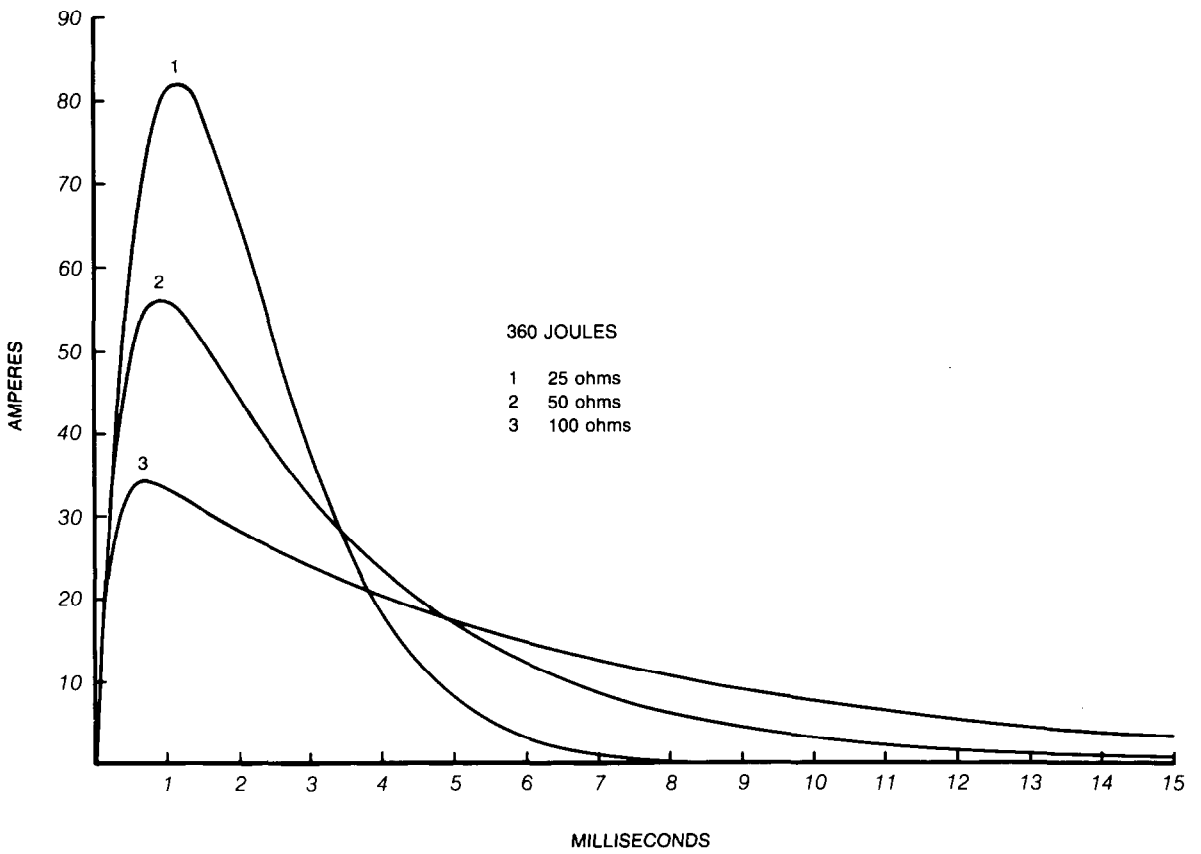
NOTES: Standard Power is 120V/60Hz.
* Standard language is English.
* Standard Power cord is U.S.

1 GENERAL INFORMATION

DEFIBRILLATOR ENERGY OUTPUT INFORMATION

The HP 43130A Defibrillator stores sufficient energy to discharge 360 joules into a 50 ohm impedance. However, the actual energy delivered into a patient is a function of the total impedance to the defibrillator discharge. As a practical matter, the operator controls the largest portion of this impedance by the quality of skin preparation, paddle placement, and pressure. If sufficient electrolyte is utilized, and pressure of 10-12 kilograms per paddle applied, then an impedance of approximately 50 ohms would be expected with the average patient. In this case, the energy delivered to the patient would equal the energy setting selected.

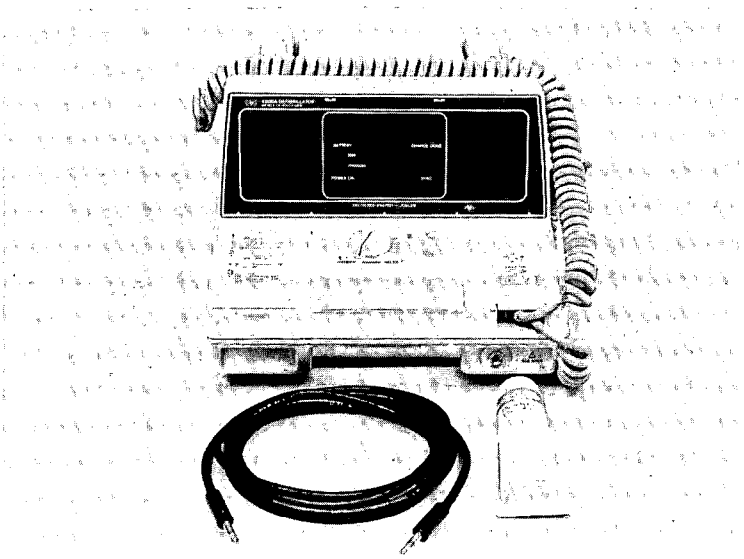
The output waveforms shown in the figure below indicate that with decreasing impedance, higher peak current is obtained. Recent clinical evidence indicates that the peak current value must reach a critical threshold for defibrillation, and should therefore be maximized. The primary method available to the operator to accomplish this, is proper paddle application technique.



INITIAL INSPECTION

Carefully inspect each container for damage. If the shipping container or cushion material is damaged, it should be kept until the contents have been checked for completeness and the instrument has been checked for mechanical and electrical integrity. The contents of the shipment should be as shown below; procedures for installation and initial checks are presented in Section 5.

If the contents are incomplete, if there is mechanical damage or if the instrument does not pass its electrical self-test (described earlier), notify your local Hewlett-Packard sales office. If the shipping container is damaged, notify the carrier also.



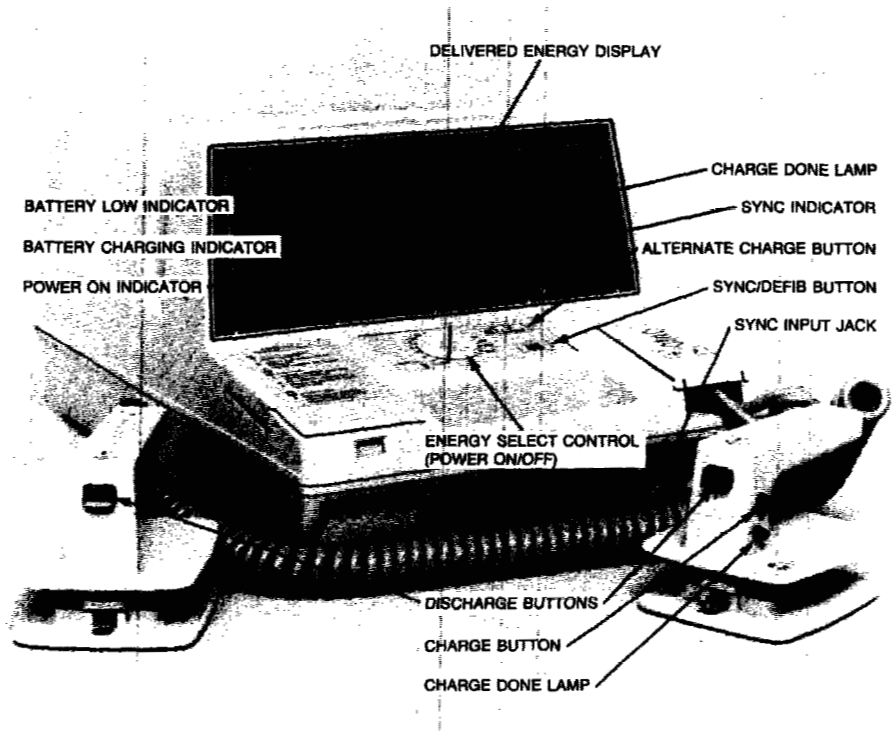
1 GENERAL INFORMATION

PACKAGING

Containers and materials used for original shipment of your HP 43130A are specifically designed for the instrument and are not readily available through Hewlett-Packard sales offices; it is recommended that you keep the packing materials for future use. If the instrument is returned to Hewlett-Packard for servicing, attach a tag indicating the product model number, serial number, return address, and a description of the problems encountered and service required. Mark the container FRAGILE to ensure careful handling. In every correspondence, refer to the instrument by product number and full serial number (e.g. HP43130A, serial number 2500A00000).

Follow these general instructions when re-packaging with commercially available materials:

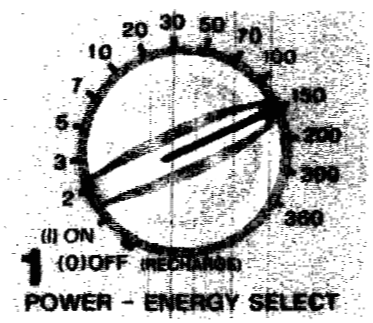
- Wrap the instrument in heavy cushioning material.
- Use a strong shipping container. A double-wall carton made of 350 pound test material is adequate.
- Use enough shock absorbing material (3 or 4 inch layer) around all sides of the instrument to provide firm cushioning and to prevent movement inside the container. Protect the control panel with cardboard.
- Seal the shipping container securely.



Model 43130A Defibrillator

1. ENERGY SELECT *control*

The ENERGY SELECT control turns the instrument power ON and OFF and also selects the desired energy level in 14 discrete steps. Switch positions are OFF, ON, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 150, 200, 300, and 360 joules (watt-seconds).



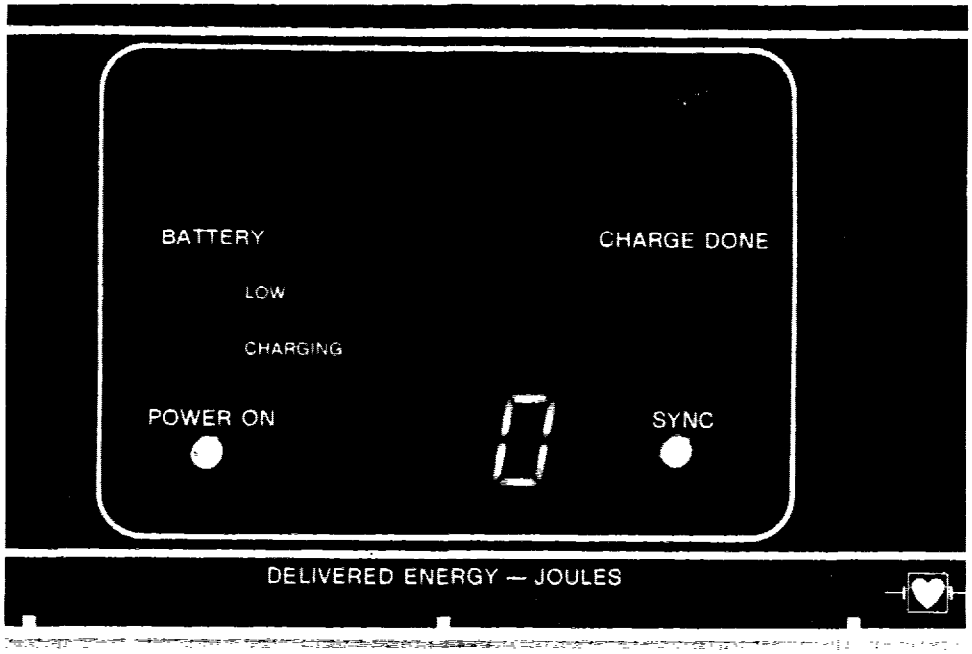
2 OPERATING CONTROLS and INDICATORS

2. CHARGE button

Press the CHARGE button on either the APEX paddle or the front panel to charge the defibrillator to the level selected with the ENERGY SELECT control. When the CHARGE button is pressed, the defibrillator charges to the selected level in 10 seconds or less when operated from a fully charged battery. To change the selected energy level AFTER the CHARGE button has been pressed, simply reset the ENERGY SELECT control. The defibrillator will automatically charge to the new level.

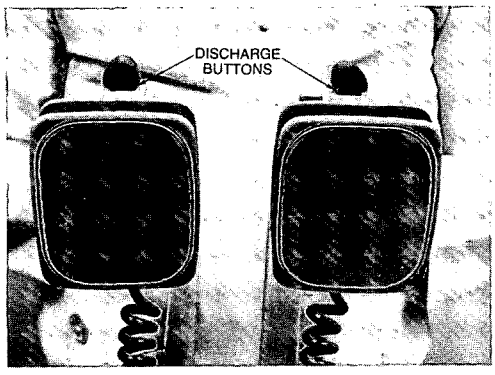
3. DELIVERED ENERGY display

The digital display on the front panel displays the energy available for defibrillator discharge. With the defibrillator disarmed, this DELIVERED ENERGY display indicates "0".



4. DISCHARGE buttons

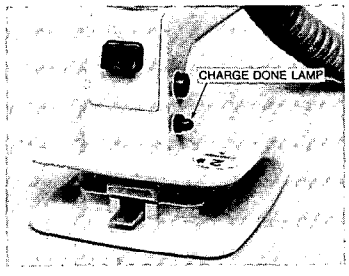
Each paddle has a DISCHARGE button located near the forward end of the handle. Press and briefly hold both buttons simultaneously to discharge the defibrillator.



5. CHARGE DONE indicators

- "CHARGE DONE" lamps, located on the APEX paddle and front panel, light and a "CHARGE DONE" tone sounds when the selected energy level has been reached. The DELIVERED ENERGY display indicates the actual energy available.

NOTE: The "CHARGE DONE" tone may be eliminated by, if desired, by removing a single diode. Refer to the HP 43130A Service Manual for further information.

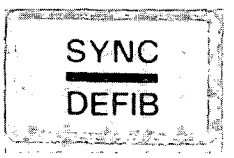


6. SYNC/DEFIB button

Pressing the SYNC/DEFIB button on the front panel changes the operating mode of the defibrillator. In DEFIB (normal) mode, the unit discharges immediately when both discharge buttons are pressed. In SYNC mode, the unit synchronizes discharge with the next detected R-wave after both discharge buttons are pressed. This mode is typically used for cardioversion procedures with the defibrillator connected to an external monitor.

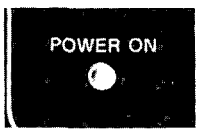
The instrument defaults to DEFIB (normal) mode when power is turned ON. For synchronized operation, press the SYNC/DEFIB button once; the "SYNC" indicator on the front panel lights while in SYNC mode. To return to normal DEFIB mode for instant discharge, press the SYNC/DEFIB button again.

The HP 43130A is designed to remain in SYNC mode after discharge (until the operator chooses to return the instrument to DEFIB mode) to avoid inadvertent non-synchronized shock delivery during cardioversion procedures. This design may differ from other manufacturers' instruments. Become familiar with the SYNC-DEFIB operation of each defibrillator you use.



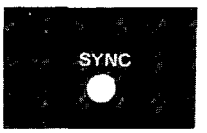
7. "POWER ON" LED

The "POWER ON" indicator lights when the instrument is turned on.



8. "SYNC"

The "SYNC" indicator lights when the instrument is placed in synchronized (SYNC) mode of operation. It flashes OFF with each detected R-wave.

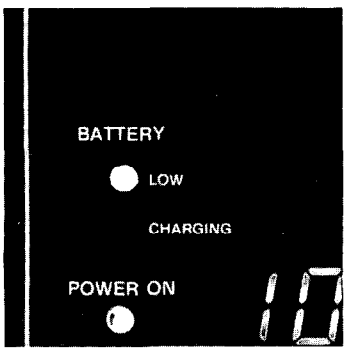


9. "CHARGE DONE" LED

The "CHARGE DONE" indicator lights when the defibrillator is charged to the selected energy level and ready for discharge.

10. "LOW BATTERY" LED

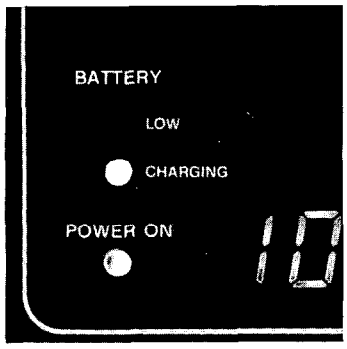
The "LOW BATTERY" indicator lights when the battery runs low and warns that a limited number of energy shocks are available. The defibrillator may be returned to AC line power (plugged in) at any time for unlimited use.



11. "BATTERY CHARGING" LED

The "BATTERY CHARGING" LED indicates that the defibrillator battery is being charged. It is lit whenever the instrument is connected to a suitable wall outlet supplying AC power and the power line switch located at the rear of the unit (if installed) is ON. To ensure that the unit has sufficient battery power to accommodate emergency episodes, and to maximize the useful life of the battery, it is recommended that the instrument remain connected to AC power during standby periods.

2 OPERATING CONTROLS and INDICATORS



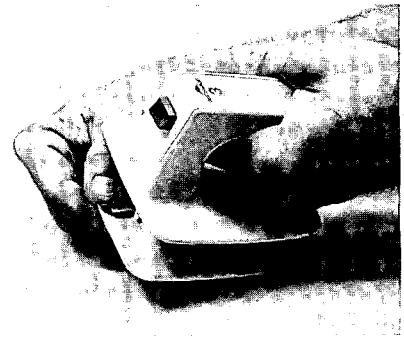
12. BATTERY PACK

The replaceable battery pack is located inside a compartment on the underside of the unit. The compartment lid is held closed by two rotating latches. (Refer to Section 6 for information regarding battery pack replacement, storage, and care.)

13. PADDLES

The HP 43130A paddle set includes both adult and pediatric electrode sizes. The adult electrodes are always exposed. To use the pediatric electrodes, remove the adult electrodes from each paddle by pressing down on the adapter locking lever and sliding the adult electrode forward. To replace the adult electrode, simply slide it back into place, making sure that the locking lever engages.

NOTE: The adult electrodes should be installed whenever the defibrillator is discharged with the paddles in their holders. If adult electrodes are not used, the paddles must be pressed firmly against the metal test contacts to avoid damage.



14. INTERCHANGEABLE PADDLE CONNECTOR

Located at the front right of the unit, the paddle connector enables quick, easy changing of the various paddle sets available for use with the 43130A. (See page 5 for a description of available paddle sets and ordering information.)

To disconnect a paddle set from the defibrillator, slide the latch cover (A) toward you, rock the connector forward and back, and pull the connector block straight up. To install an alternate paddle set, press the paddle connector down into place, and slide the latch back.

---

15. POWER CORD STORAGE RECESS

The power cord may be quickly and easily coiled into the recessed compartment located in the rear of the instrument case, when transport is necessary. The compartment "captures" the cord, keeping it out of the way during an emergency episode, and allows easy removal when the unit is returned to AC line power. The power cord plugs into the receptacle located in this compartment, and may be secured with the power cord retainer included in the accessory kit.

---

16. ECG/SYNC Input

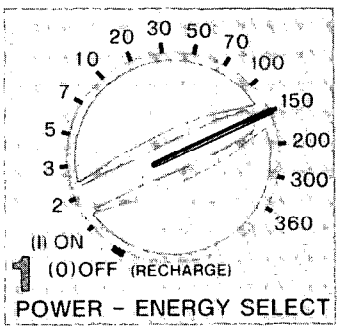
The standard phone jack allows the HP 43130A to be synchronized with the signal from an HP bedside monitor. Connect the SYNC cable to the ECG or SYNC output of the monitor and to the ECG/SYNC input on the HP 43130A. The defibrillator will synchronize from the signal, return a "marker pulse" to the monitor for verification, and time the energy discharge to occur at the trigger point.

2 OPERATING CONTROLS and INDICATORS

NOTES

SELECT ENERGY

Turn the ENERGY SELECT control to the desired energy level. (This turns the instrument power on automatically.)



PREPARE PADDLES

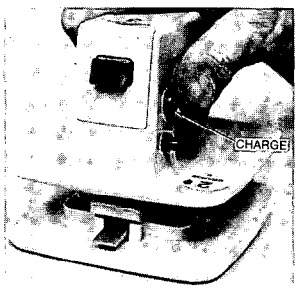
- Remove the paddles from their holders by grasping the handles and lifting straight up.
- Apply a liberal amount of Redux® paste to the electrode surface of each paddle, or use defibrillator pads. TO AVOID RISK OF ELECTRICAL SHOCK TO THE OPERATOR, DO NOT ALLOW PASTE TO ACCUMULATE ON THE HANDS OR THE PADDLE HANDLES.
- Gently rub the electrode surfaces together to evenly distribute the applied paste.

APPLY PADDLES TO CHEST

- Apply the paddles firmly to the anterior wall of the chest. The left (STERNUM) paddle should be placed to the right of the sternum just below the clavicle; the right (APEX) paddle should be placed on the chest wall, just below and to the left of the left nipple, in the anterior-axillary line.
- Rub the paddles slightly against the skin to maximize the paddle-to-patient contact. DO NOT ALLOW PASTE TO ACCUMULATE BETWEEN THE PADDLE ELECTRODES ON THE CHEST WALL - THIS COULD CAUSE BURNS.
- Recommended applied pressure is 10-12 kg (22-25 lb) per paddle.

3 EMERGENCY DEFIBRILLATION PROCEDURES

CHARGE DEFIBRILLATOR



- Press the CHARGE button on either the right (APEX) paddle or on the instrument front panel.

- When the "CHARGE DONE" tone sounds, and the "CHARGE DONE" lamps light, the DELIVERED ENERGY display will indicate the available energy.

NOTE: Should you need to disarm the charged defibrillator (if countershock is not needed), turn the ENERGY SELECT control to the ON position. Any stored energy will be discharged internally and the monitor DELIVERED ENERGY display will return to "0".

NOTE: If the defibrillator will not charge, verify proper setting of the ENERGY SELECT control. If it is correct, turn the ENERGY SELECT control to OFF, and then back to the desired energy setting and press the CHARGE button again. If the unit remains unable to charge, turn the ENERGY SELECT control to the ON or OFF position and use a back-up defibrillator. Alert appropriate service personnel as soon as possible.

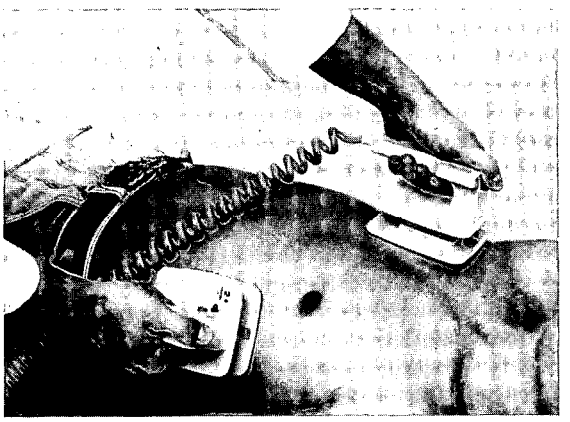
As a safety feature, if the defibrillator is not discharged within 60 seconds of reaching the selected energy level, it will automatically discharge the stored energy internally. During the ten seconds just prior to this internal disarm, the "CHARGE DONE" tone will beep intermittently. When the internal discharge occurs, the "CHARGE DONE" tone will stop, the "CHARGE DONE" lamp will go off, and the DELIVERED ENERGY display will return to "0".

TO RESET SELECTED ENERGY LEVEL

To increase or decrease the selected energy level after the CHARGE button has been pressed, simply move the ENERGY SELECT control to the new energy level, and wait for the CHARGE DONE tone and lamp to activate.

DISCHARGE

- Briefly adjust paddle pressure and placement to optimize patient contact.
- Verify that no one is in contact with the patient, monitoring cable or leads, bed rails, or any other potential current pathway.
- Call out "CLEAR" to alert other personnel to stand clear of the patient.
- Press and briefly hold both DISCHARGE buttons (one on each paddle) simultaneously, to deliver energy to the patient.



NOTE: If the defibrillator does not discharge, press the CHARGE button again, wait for the "CHARGE DONE" tone, and press the DISCHARGE buttons again. If it still will not discharge, turn the ENERGY SELECT control to the ON or OFF position, and use a back-up defibrillator. Alert appropriate service personnel immediately.

AFTER USE

- Turn the ENERGY SELECT control to OFF.
- Return the instrument to its storage location, and plug the power cord into an AC power outlet. Verify that the "BATTERY CHARGING" LED lights.
- Clean all paddles, controls, and cables as necessary. (Refer to Section 6 for detailed cleaning information.)
- Check that adequate remaining recorder paper and electrolyte paste or defibrillator pads are available for the next use of the defibrillator.

3 EMERGENCY DEFIBRILLATION PROCEDURES

NOTES

Certain arrhythmias require synchronizing defibrillator discharge with the ECG R-wave to avoid inducing ventricular fibrillation. In this case, a synchronizing (SYNC) circuit within the instrument detects the patient's R-waves. When the discharge buttons are pressed, the unit will discharge with the next detected R-wave, thus avoiding the vulnerable T-wave segment of the cardiac cycle.

When the HP 43130A is placed in SYNC mode for synchronized cardioversion, a marker pulse is superimposed on the ECG as it appears on the monitor to indicate the point in the cardiac cycle where discharge will occur.

- Place the ENERGY SELECT control in the ON position.

- Select desired ECG lead on the monitor.Connect the ECG/SYNC output jack to the ECG/SYNC input jack on the HP 43130A using cable part number 8120-1022.

- Press the SYNC/DEFIB button once to place the HP 43130A in SYNC mode. The "SYNC" indicator will light on the front panel and will flash OFF with each detected R-wave.

- Always inspect the displayed ECG before delivering the countershock, and verify that a marker pulse (indicating discharge point) appears only with each R-wave. Should a marker pulse not appear, or if a marker pulse is viewed on the T-wave segment of the ECG, adjust the ECG size until the marker pulse appears only with each R-wave. Select a different lead or adjust electrode placement, if necesary, to improve ECG R-wave quality.

VERIFY DEFIBRILLATOR OPERATION BEFORE PROCEEDING

Perform the following brief test to ensure proper defibrillator performance:

- Place the ENERGY SELECT control in the "100" joules position.

- Verify that the adult paddle electrodes are installed.

- Leaving the paddles in their holders, press either CHARGE button. Wait for the "CHARGE DONE" indicators, and for the DELIVERED ENERGY display to read "100" joules.

- With the paddles pressed firmly into their holders, press and briefly hold both discharge buttons simultaneously; the defibrillator will discharge with the next detected R-wave. After discharge,the DELIVERED ENERGY display should indicate "100" joules, the actual measured energy delivered to the internal test-load.

4 ELECTIVE CARDIOVERSION

SELECT ENERGY

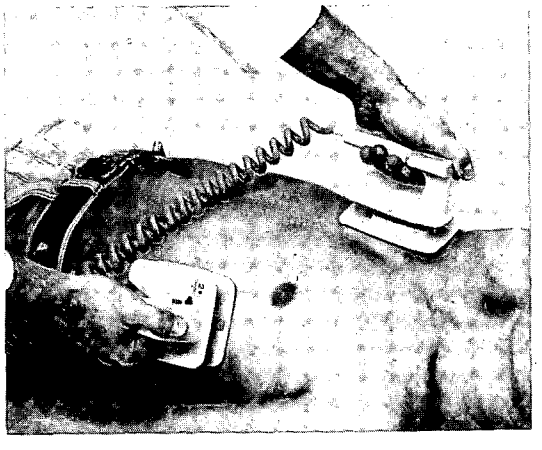
- Select the desired energy level with the ENERGY SELECT control.

PREPARE PADDLES

- Remove paddles from their holders by grasping the handles and lifting straight up.
- Apply a liberal amount of REDUX® paste to the electrode surface on each paddle or use defibrillator pads. TO AVOID RISK OF ELECTRICAL SHOCK TO THE OPERATOR, DO NOT ALLOW PASTE TO ACCUMULATE ON THE HANDS OR THE PADDLE HANDLES.
- Gently rub the electrode surfaces together to evenly distribute the applied paste.

APPLY PADDLES TO CHEST

- Apply the paddles firmly to the anterior wall of the chest. The left (STERNUM) paddle should be placed to the right of the sternum just below the clavicle; the right (APEX) paddle should be placed on the chest wall, just below and to the left of the left nipple, in the anterior-axillary line.



- Rub the paddles slightly against the skin to maximize the paddle-to-patient contact. DO NOT ALLOW PASTE TO ACCUMULATE BETWEEN THE PADDLE ELECTRODES ON THE CHEST WALL - THIS COULD CAUSE BURNS.
- Recommended applied pressure is 10-12 kg (22-25 lb) per paddle.

CHARGE DEFIBRILLATOR

- Press the CHARGE button on either the right (APEX) paddle or on the instrument front panel.

- When the "CHARGE DONE" tone sounds and the "CHARGE DONE" lamp lights, the DELIVERED ENERGY display on the monitor will indicate the available energy.

NOTE: Should you need to disarm the charged defibrillator (if countershock is not needed), turn the ENERGY SELECT control to the ON position. Any stored energy will be discharged internally and the monitor DELIVERED ENERGY display will return to "0".

NOTE: If the defibrillator does not charge, verify proper setting of the ENERGY SELECT control. If it is correct, turn the ENERGY SELECT control to OFF, and then back to the desired energy setting, reset the SYNC/DEFIB and ECG SIZE controls, and press the CHARGE button again. If the unit remains unable to charge, turn the ENERGY SELECT control to OFF and use a back-up defibrillator. Alert appropriate service personnel.

As a safety feature, if the defibrillator is not discharged within 60 seconds of reaching the selected energy level, it will automatically discharge the stored energy internally. During the ten seconds just prior to this internal disarm, the "CHARGE DONE" tone will beep intermittently. When the internal discharge is complete, the "CHARGE DONE" tone will terminate, the "CHARGE DONE" lamp will go off, the recorder will annotate "DISARMED", and the monitor DELIVERED ENERGY display will return to "0".

TO RESET SELECTED ENERGY LEVEL

To increase or decrease the selected energy level after the CHARGE button has been pressed, simply move the ENERGY SELECT control to the new energy level, and wait for the CHARGE DONE tone.

4 ELECTIVE CARDIOVERSION

DISCHARGE

- Verify again that the ECG waveform is stable, and that a marker pulse appears ONLY with each R-wave of the cardiac cycle.
- Briefly adjust paddle pressure and placement to optimize contact.
- Press and briefly hold both DISCHARGE buttons (one on each paddle) simultaneously. The defibrillator will discharge with the next detected R-wave.
- If additional countershocks are required, readjust the ENERGY SELECT control as necessary, and repeat the above procedure.

NOTE: If the defibrillator does not discharge press the CHARGE button again, wait for the "CHARGE DONE" tone, and press the DISCHARGE buttons again. If it still will not discharge, turn the ENERGY SELECT control to the ON or OFF position, and use a back-up defibrillator. Alert appropriate service personnel immediately.

AFTER USE

- Turn the ENERGY SELECT control to OFF.
- Return the instrument to its storage location, and plug the power cord into an AC power outlet. Verify that the "BATTERY CHARGING" LED lights.
- Clean all paddles, controls, and cables as necessary. (Refer to Section 6 for information on cleaning the defibrillator.)
- Check that adequate remaining recorder paper and electrolyte paste or defibrillator pads are available for the next use of the defibrillator.

CHECKOUT PROCEDURE • SECTION 5

The following procedure allows complete functional inspection of the Model 43130A Defibrillator/Monitor. A simplified inspection routine for daily and weekly testing is included in Section 7.

- Plug the power cord into suitable AC power outlet and check that the power line switch located at the rear of the unit (if installed) is on.

- Place the ENERGY SELECT control in the ON position. The POWER ON indicator will light.

- Verify that the adult paddle electrodes are installed.

- Place the ENERGY SELECT control in the 100 joules position. Leaving the paddles in their holders, press either CHARGE button. The "CHARGE DONE" tone should sound and the "CHARGE DONE" lamp should light within 10 seconds when operated with a fully charged battery, and the DELIVERED ENERGY display should register "100" joules.

- **WARNING:** Ensure that hands are kept clear of the paddle electrode edges; use thumbs to depress DISCHARGE buttons.

- Grasp the paddle handles, and without removing the paddles from their holders, press both DISCHARGE buttons simultaneously. The DELIVERED ENERGY display will indicate the actual energy (+/– 10%) delivered to the the internal 50ohm test load.

  The defibrillator is ready for use if it passes the above checklist.

CAUTION: DO NOT DISCHARGE THE DEFIBRILLATOR WITH THE PADDLES SHORTED TOGETHER. TO DO SO CAN CAUSE BURNING AND PITTING OF THE METAL PADDLE CONTACTS.

WARNING: AVOID OPEN PADDLE DISCHARGES. DANGEROUS HIGH VOLTAGE EXISTS ON THE PADDLES WHEN THE DEFIBRILLATOR IS DISCHARGED. CONTACT WITH THIS HIGH VOLTAGE COULD CAUSE DEATH OR SERIOUS INJURY.

5 CHECKOUT PROCEDURES

NOTES

BATTERY INFORMATION

The following information will help you gain the most benefit from the lead-acid battery (HP part number 1420-0339) which is used in the HP 43130A defibrillator.

As soon as your new defibrillator arrives, check it out according to the Checkout Procedure (Section 5), and connect it to AC power for at least 24 hours (48 hours or more is preferred). The battery is charged at the factory, but some discharging will occur even when the defibrillator power control is in the "OFF" position, or when the battery is out of the instrument.

To prolong battery life, Hewlett-Packard defibrillators have a feature which turns off the instrument when battery capacity is low. IMPORTANT: A battery discharged to the defibrillator shutdown point will still allow immediate AC line power operation. A DEFECTIVE (SHORT-CIRCUIT OR OPEN-CIRCUIT) BATTERY WILL PREVENT THE USE OF THE DEFIBRILLATOR, EVEN WHILE ON AC POWER.

As with most battery-operated equipment, IT IS STRONGLY RECOMMENDED THAT THE DEFIBRILLATOR BE LEFT PLUGGED INTO AC LINE POWER DURING STANDBY PERIODS TO PROVIDE CONSTANT BATTERY CHARGING. Always verify that the "BATTERY CHARGING" indicator is on when the unit is on AC power. The battery does not require periodic discharge cycling maintenance to correct voltage depression or 'memory' problems common with NiCad (nickel-cadmium) batteries.

6 OPERATOR SERVICE

BATTERY CHECK

Hewlett-Packard recommends that the battery (HP part number 1420-0339) capacity be checked periodically (every three months or when questionable ity is noticed). Since the 43130A Defibrillator does not include a monitor which provides a convenient method of capacity determination, we recommend that

1) for capacity checking the battery be installed in an HP unit with a monitor (Models 43100A, 43110A, 43120A or 43200A), or

2) the battery be replaced after being in service one year.

In general, use of this check should not exceed the frequency recommended by Hewlett-Packard, since repeated deep discharges will tend to decrease the battery's total useful life. REMEMBER THAT THE BATTERY SHOULD BE LEFT ON CHARGE WHENEVER POSSIBLE FOR BEST PERFORMANCE AND LIFE.

CHANGING THE BATTERY PACK

- THE HP 43130A MUST HAVE A BATTERY INSTALLED TO OPERATE.
- Place the unit on its back or side.
- Open the battery compartment door by rotating the two latches.
- Unplug the battery cable from the defibrillator.
- Replace with a new battery and secure the compartment door.
- Charge battery for 24 hours before putting into service to achieve maximum battery capacity.

BATTERY STORAGE

Beyond a preliminary full charge, no preparation is required for storage of the battery. A 48-hour charge is sufficient preparation. Batteries should be stored in a cool, dry location.

Lead-acid batteries have a finite shelf life (storage time) before they become non-functional. A lead-acid battery in storage should be recharged for at least 24 hours every six months. This will help ensure the battery does not become excessively discharged while in storage, even though the shelf discharge rate is low. The shelf life is longer with colder temperatures, but do not store below freezing level.

Prolonged storage of the battery off charge could result in an abnormal condition where it will not recharge even when the defibrillator is connected to AC power. The condition (open circuit voltage below about 10.8 volts) could occur if the battery is stored longer than six months without recharging or left in the instrument off charge for more than four months from a fully-charged state. The difference in time is because the instrument draws a small amount of current even when the power switch is off. The diagnosis of this condiiton is simple. When the unit is plugged into AC line power, the 'BATTERY CHARGING' indicator will flash briefly once approximately every five seconds, and will be accompanied by a relay 'click' within the instrument. The battery must be replaced in this situation.

For best results, observe the battery recharge recommendations which have been added to the shipping carton and battery labels. A label on the shipping carton next to the packing slip provides a date prior to which the instrument should be plugged in and the battery must be recharged. In addition, a caution label on the battery pack states that the battery should be recharged (for at least 24 hours) every six months.

- Observe the same storage environment limits for the battery as suggested for the instrument (Section 1):

  Temperature: -40° C to 75° C
  Relative Humidity: 50% to 95% (40° C)

NOTE: *The battery must be charged if stored below zero C to avoid damage.*

6 OPERATOR SERVICE

CLEANING EXTERIOR SUFACES

- The 43130A and its acessories are chemically resistant to common hospital cleaning solutions and non-caustic detergents. Some approved cleaning solutions are:

  - Alcohol
  -Soap and water
  -Chlorine bleach (30ml/l water)
  -Ammonia-based cleaners

- Keep the outside surface of the instrument clean and free of dust and dirt. Clean the paddles thorughly to prevent build-up of dried electrolyte.

- When alternate paddle sets are used, be especially careful to avoid the accumulation of fluids in the paddle connector well.

- DO NOT allow any fluids to penetrate the instrument case, and avoid pouring fluid on the unit while cleaning. DO NOT use abrasive cleaners or strong solvents such as acetone, or acetone-based componds.

- DO NOT steam or gas (ETO) sterilize the external paddle set.

NOTE: For information regarding the use and sterilization of HP Internal Handle and Electrode sets, consult the documentation accompanying those products.

OPERATIONAL CHECKS • SECTION 7

These checks are intended to briefly verify proper operation of the 43130A Defibrllator. A test routine incorporating these checks along with visual inspection for mechanical integrity of all cables, paddles, and controls should be performed regularly as indicated below.

EVERY SHIFT

- Verify that the instrument is connected to AC power and that the "BATTERY CHARGING" LED is lit.
- Check for presence of adequate REDUX® electrolyte paste or defibrillator pads.

EVERY WEEK

Delivered energy check:

- Place the ENERGY SELECT control in the "100 " position.
- Verify that the adult paddle electrodes are installed.
- Leaving the paddles in their holders, press either CHARGE button. Wait for the "CHARGE DONE" tone to sound and thee "CHARGE DONE" lamp to light and verify that the DELIVERED ENERGY display registers "100" joules.
- **WARNING:** Ensure that hands are kept clear of the paddle electrode edges; use thumbs to depress DISCHARGE buttons.
- Grasp the paddle handles and, leaving the paddles in their holders, press and briefly hold both DISCHARGE buttons simultaneously. The DELIVERED ENERGY display will indicate the actual energy (+/– 10%) delivered into the internal 50ohm test load. Notify service personnel if any delivered energy value other than "100" joules is indicated.

See the HP 43130A SERVICE MANUAL for extensive electrical, operational, and safety tests which should be performed by a qualified Biomedical Electronics Technician (BMET) or equivalent service technician every 6 months.

For more information, call your local HP sales office or East (301) 948-6370 • Midwest (312) 255-9800 • South (404) 955-1500 • West (213) 877-1282; or write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. **In Europe,** Hewlett-Packard S.A., 7, rue du Bois-du-lan, P.O. Box CH-1217, Meyrin 2, Geneva, Switzerland. **In Japan,** Yokogawa-Hewlett-Packard Ltd., 29-21, Takaido-Higashi 3-chome, Suginami-ku, Tokyo 168.

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HEWLETT PACKARD

2-1. INTRODUCTION

This section describes the theory of operation of the 43130A defibrillator. It is primarily board oriented; i.e., discussion of various system components is contained in the section relating to the printed circuit board which connects to them, e.g. the battery is discussed under Battery Charger board.

2-2. SYSTEM OVERVIEW

The unit is comprised of five major circuitry assemblies, four of which are contained on printed circuit boards. These five assemblies are the Control board, Display board, High Voltage Charger board, High Voltage Circuit, and Battery Charger board.

A. CONTROL BOARD

- Reads front panel operator inputs
- Controls the defibrillator charge and discharge sequences
- Controls front panel display
- Performs ECG processing for the synchronizer.

B. DISPLAY BOARD

- Provides the drive signals for Energy display and discrete LED indicators on the front panel display

C. HIGH VOLTAGE CHARGER BOARD

- Generates voltage to charge the HV Capacitor
- Provides an indication of the HV Capacitor voltage to the Control board
- Provides safety discharge of the HV Capacitor.

D. HIGH VOLTAGE CIRCUITRY

- Delivers current with a specified waveform to a load between the defibrillator paddles
- Provides an indication of the discharge current to the Control board
- Provides a test load for discharge of the HV Capacitor.

E. BATTERY CHARGER BOARD

- Isolates and conditions line voltage to charge the battery
- Provides several low voltages to power other circuitry.

2-3. CONTROL BOARD

The control board circuitry is comprised of a control processor, gate array, analog-to-digital conversion circuitry, speaker circuit, front panel switch logic, processor reset circuit, marker pulse circuit, and front panel display voltage supply.

2-4. MAIN CONTROL PROCESSOR

U61, the control processor, is an 8051 single-chip microcontroller. It is the heart of the Control board circuitry. System control is accomplished either directly, from the processor's own I/O ports; or indirectly, through the control gate array's I/O lines.

The processor's software is executed once every 4.167 ms on a cyclic basis. The 4.167 ms software cycle is generated by a timer internal to the processor. Software functions include servicing the A/D converter; updating the display; reading the front panel switches, energy select switch, and paddle switches; digital filtering of the patient ECG for the synchronizer; HV capacitor charge and discharge control; and system diagnostics.

2-5. CONTROL GATE ARRAY

The control gate array, U62, is a collection of several smaller digital circuits. It generates many of the system timing signals, and provides I/O expansion for the control processor. The major functional areas of the gate array are the clock oscillator, system timing chain, memory map control logic, control registers, switch control logic, tickle/reset circuit, speaker tones, and charge rate control.

2-6. CLOCK OSCILLATOR

The processor and the gate array are driven by a 12Mhz crystal controlled oscillator. This oscillator is part of the gate array. See Figure 2-1. The external circuitry for the oscillator consists of R48, R49, C34, C35, and Y1. The oscillator input is XTALIN pin 6, and the output XTALOUT is pin 7 of U62. The signal OSCOUT is a buffered output of the oscillator. This signal is used internal to the gate array for driving the system timing chain, and external for driving the clock input of the processor (U61-18).

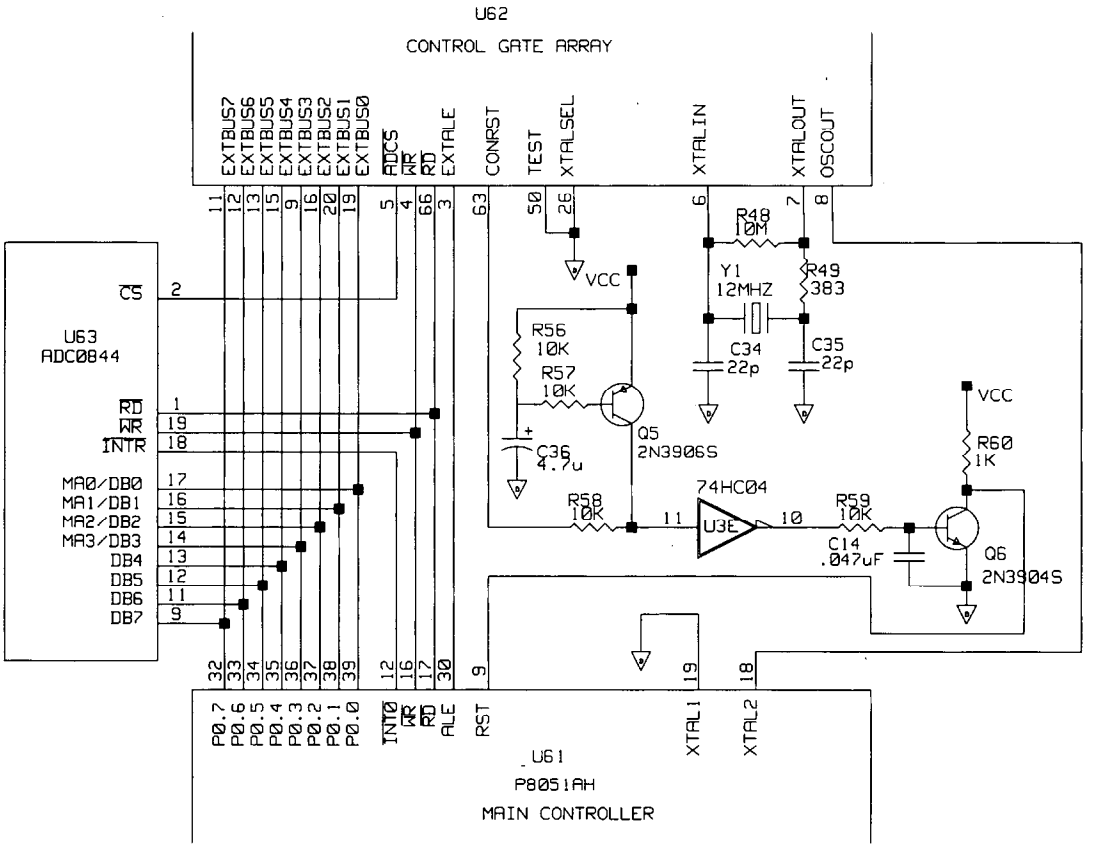


Figure 2-1. Memory Mapped I/O.

2-7. MEMORY MAPPED I/O

The gate array control registers, the switch control logic; as well as, the A/D converter (U63) are configured as memory mapped I/O to the processor. Port P0 (pins 32 to 39) of the processor is used as the external address/data bus. The control gate array and A/D converter are connected to this bus as shown in Figure 2-1. The memory map control logic is located internal to the gate array. It consists of an address latch and combinational logic to decode the address. The memory mapped devices are accessed by data memory read/write instructions from the processor.

2-8. GATE ARRAY CONTROL REGISTERS

There are three registers internal to the control gate array, that are configured as external memory locations to the processor. They are used for internal control of the gate array, and also as direct outputs to other parts of the system. Each register is updated once every 4.167 ms software cycle.

2-9. ANALOG/DIGITAL CONVERSION

U63 is an 8-bit successive approximation A/D converter. The converter has an internal 4 channel analog multiplexer, and generates its own timing with an internal clock. Typical conversion times are 40 microseconds. A +5 volt 1% voltage reference, U67, is used as the reference input to pin U63-8.

An A/D conversion is initiated when the processor executes an external data memory write instruction to the address the A/D converter occupies in the memory map. See Figure 2-2. When this occurs, pin U62-5 from the gate array goes low and selects the A/D converter, U63. The data written to the A/D converter is the multiplexer channel address of the signal intended for conversion. The actual conversion begins when the write signal, pin U63-19, returns high at the end of the external data memory write instruction from U61. After the conversion is completed, the A/D interrupt signal, pin U63-18, goes low and generates an interrupt at pin 12 of U61. The processor, U61, reads the conversion result with an external data memory read instruction, and then starts another conversion.

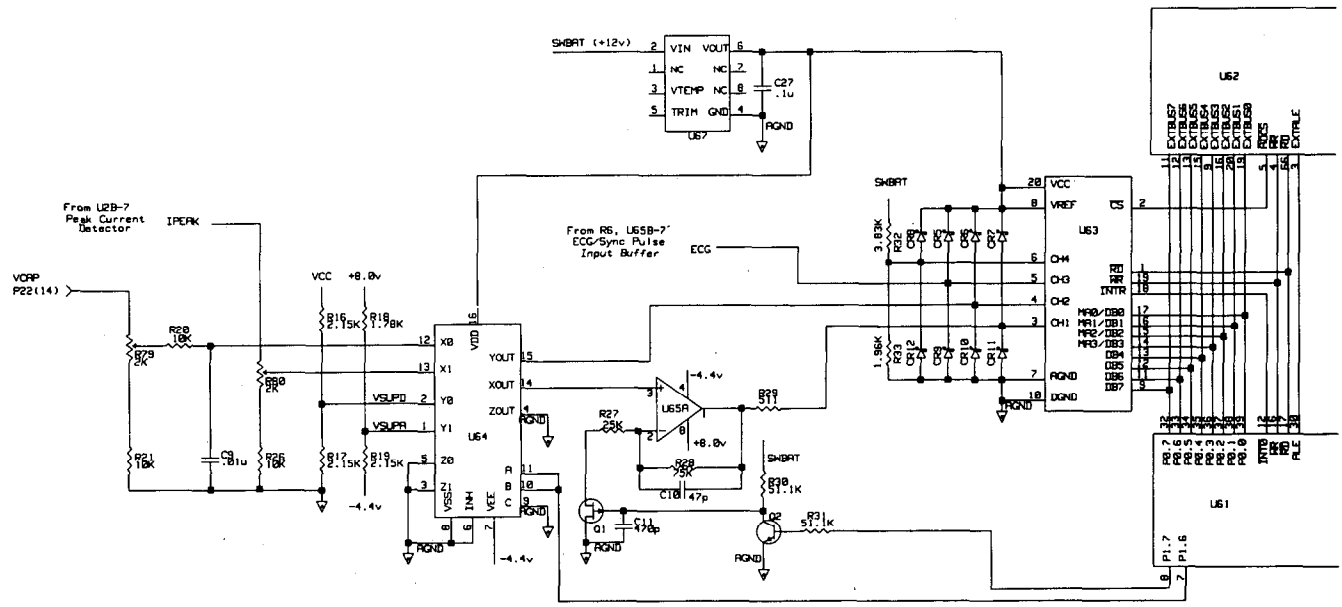


Figure 2-2. A/D Convert.

Five to six A/D conversions are performed each 4.167 ms software cycle. Conversions are done on the patient ECG signal (ECG), HV capacitor voltage signal (VCAP), battery voltage (SWBAT), and supply voltages (VSUPD and VSUPA). The order of conversions is ECG, VCAP (at unity gain), SWBAT, VCAP (at 4x gain), VSUPD, and VSUPA. The second conversion of VCAP (at 4x gain) is done only if the first conversion (at unity gain) is less than 1.2 volts. The second conversion of VCAP is done after the SWBAT conversion, to give the gain of U65A time to settle after being changed. An A/D conversion of the peak discharge current signal IPEAK is performed during the discharge sequence.

The output signal of the ECG/Sync pulse buffer stage, U65B, is input to Channel 3 of the A/D converter (pin 5 of U63). Diodes CR5 and CR9 serve as input protection for U63.

The battery voltage SWBAT is divided down by resistors R32 and R33. The divided signal is input to Channel 4 of the A/D converter (pin 6 of U63). Diodes CR16 and CR17 are used as input protection for U63.

The HV capacitor voltage signal (from the Defibrillator Charger board) is divided down through potentiometer R79 and resistor R21. This divider is used to adjust out the component tolerance of the HV capacitor, and calibrate the delivered energy. The divided VCAP signal is input to X0 (pin 12) of U64. Similarly, the peak discharge current signal IPEAK is divided down through R80 and R26. The IPEAK divider is used to calibrate the test energy accuracy. The divided IPEAK signal is input to X1 (pin 13) of U64.

The digital +5 volt supply is divided down through resistors R16 and R17 to obtain the signal VSUPD. This signal is input to Y0 (pin 2) of U64. The analog +8 volt and −4.4 volt supplies are summed together through resistors R18 and R19 to obtain the signal VSUPA. This signal is then input to Y1 (pin 1) of U64.

U64 is a triple 2 to 1 analog multiplexer. The control inputs A (pin 11) and B (pin 10) for outputs XOUT (pin 14) and YOUT (pin 15) are both connected to P1.6 (pin U61-7) of the main control processor. When P1.6 is low, the signals VCAP and VSUPD are output at XOUT and YOUT respectively. When P1.6 is high, the signals IPEAK and VSUPA are output at XOUT and YOUT of U64. The signal XOUT is input to the gain stage U65A. The signal YOUT is input to Channel 2 (pin 4) of the A/D converter. Diodes CR6 and CR10 act as input protection for Channel 2.

U65A is configured as a programmable non-inverting gain stage, and the gain is determined by the state of transistor Q1. When Q1 is pinched-off, the gain is unity; and when Q63 is on, the gain is 4. The state of Q1 is controlled by the main control processor, through transistor Q2. When Q2 is on, the gate of Q2 is at ground, and Q1 is on; and when Q2 is off, the gate of Q1 is pulled to +12 volts and Q1 is pinched-off. Resistors R27 and R28 set the gain when Q1 is on. Capacitors C10 and C11 are for noise suppression, when Q1 and Q2 are switching.

2-10. ECG/SYNC PULSE INPUT BUFFER, (Figure 2-3)

A high level ECG or Sync pulse from an external monitor is input to connector J26. This signal is then input to filter stage U65B. This filter stage is an inverting buffer amplifier with passband from approximately 0.5 to 55 Hz. The input signal's characterisitics can be either a pre-amplified analog ECG, from .5 to 5 volts in amplitude; or a positive going sync pulse, up to 180 ms wide and from 3 to 12 volts in amplitude. If the input is a sync pulse, R6, R7, CR3, and C5 will remove the "sharpness" of the falling edge, thus preventing synchronization with the trailing edge of the marker. The output of this buffer is input to Channel 3 of the A/D converter.

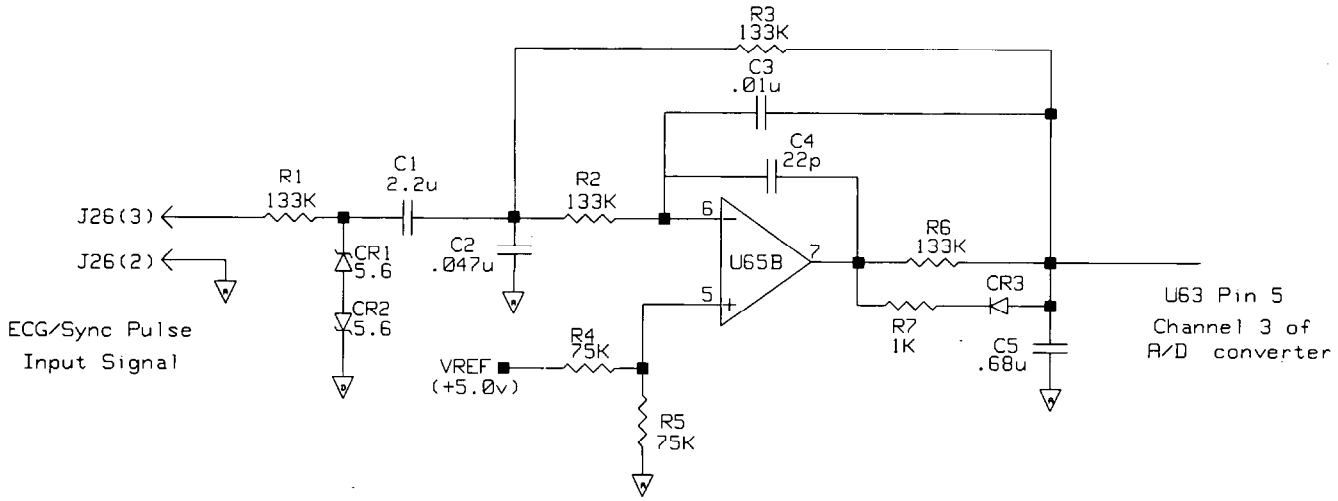


Figure 2-3. ECG/SYNC Pulse Input Buffer.

2-11. PEAK CURRENT DETECTOR

During a test discharge, the peak discharge current through the test load is measured, and used to calculate the energy delivered. The discharge current flows through a 1:2500 current stepdown transformer, T1, mounted in the lower case. The proportional secondary current is converted to a voltage by R23. This voltage is then integrated and held by the peak hold circuit; which consists of open collector comparator U1B, op-amp U2B, resistor R24 and capacitor C8. The output of the peak hold circuit is IPEAK, which is then divided down through R80 and R26 (for calibration purposes), and input to X1 of U64. The peak hold circuit is reset by the processor, via a gate array control register, through R25 and U62 pin 54. R22 and C7 perform a low pass filtering function to prevent noise from disturbing the peak current reading. (See Figure 2-4.)

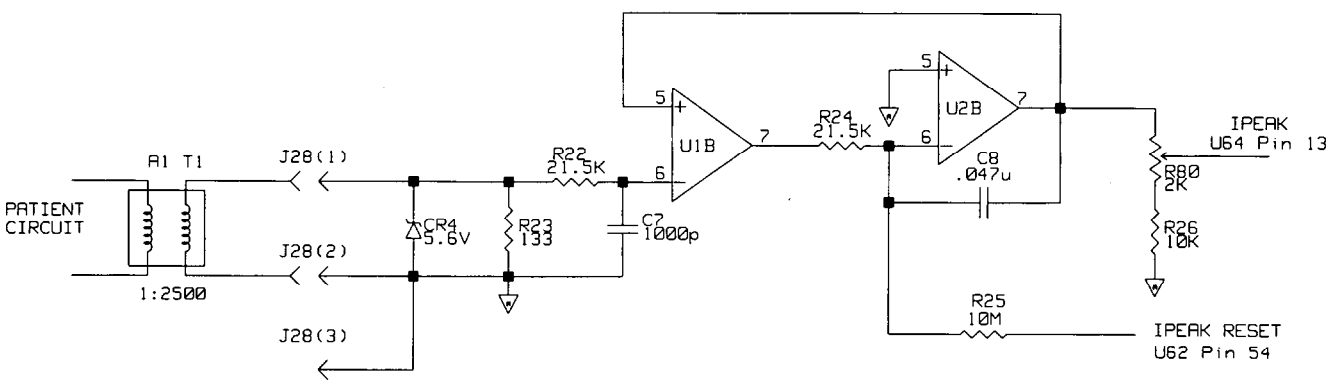


Figure 2-4. Peak Current Detector.

2-12. SWITCH CONTROL LOGIC, (Figure 2-5)

The front panel switches, paddles in pockets switch, and the option switches on the Control board are input to processor thru the gate array. The processor reads these switches by executing a data memory read to a specific address. The switches are read each software cycle and debounced in software.

Pin 2 of U62 serves a special function in the switch logic. It is read into the control processor to check if the instrument's power has just been turned on. Capacitor C6 is connected to pin 2 and charged through a pull-up transistor internal to U62. The main control processor checks the logic level of pin 2 (which effectively is the charge on C6) to determine if the unit has recently been turned on.

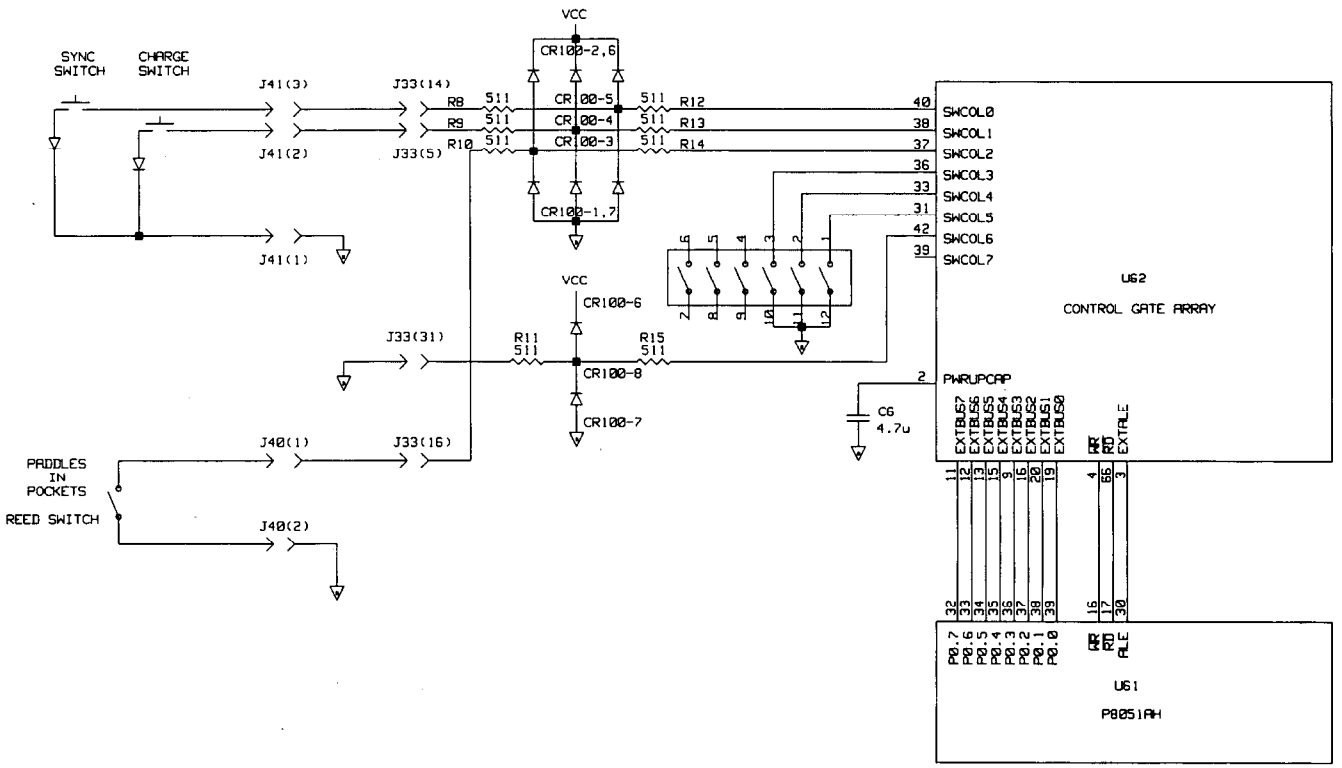


Figure 2-5. Switch Control Logic.

2-13. SPEAKER CIRCUITRY, (Figure 2-6)

The speaker circuit generates the power-up tone, charge done tone, and the QRS beeper tone. The tones are derived from the control gate array signals CHGTONE (pin U62- 23), and RWTONE (pin U62-10). The signal CHGTONE is a 1953 Hz square wave, and RWTONE is a 1736 Hz square wave. The processor controls which signal is enabled, through the gate array control registers.

The signals CHGTONE and RWTONE are "diode OR'ed" together to drive the base of transistor Q7, which drives the speaker DS61. DS61 is connected from the +5v supply to ground, through the collector-emitter junction of Q7. Capacitor C19 provides energy storage for the speakers current surges.

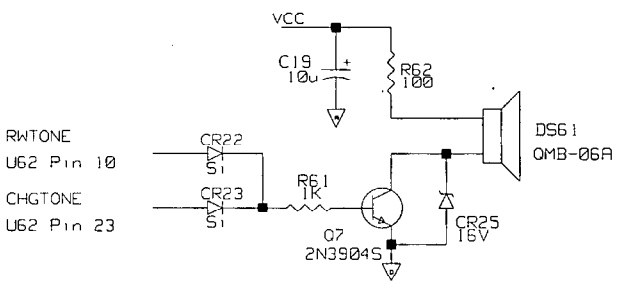


Figure 2-6. Speaker Circuitry.

2-14. TICKLE/RESET CIRCUIT

The tickle/reset circuit, inside the control gate array, provides a means of software recovery for the processor. This is a useful circuit when operating in an electrically noisy environment. The circuit is basically a ripple counter that is driven by the system timing chain internal to the gate array. If allowed to run freely, the counter output CONRST (pin U62-63) will generate a signal that is 6.4 ms high and 6.4 ms low. An additional circuit makes it possible to change this signal to 44.8 ms high and 6.4 ms low. The pulse duration is programmed through one of the gate array control registers. During normal operation the 6.4 ms pulse duration is selected. The 44.8 ms pulse duration is used during the discharge sequence.

The signal CONRST is connected into the power-up reset circuit consisting of Q5, Q6, U3E, R56, R57, R58, R59, R60, C36, and C14. The output of this circuit is input to the RST pin of the processor (U61-9). Thus the processor can be reset by either the gate array or the power-up circuit. See Figure 2-1.

Under normal operation, the main control processor "tickles" or resets the tickle/reset ripple counter once each 4.167 ms software cycle. This prevents CONRST from ever going high and resetting the main control processor. However, if the processor operation is upset by electrical noise and fails to "tickle", then CONRST will reset the processor within 6.4 ms. When reset, the software will start over from program address location 0; and "tickle" rapidly for 25 ms before resuming normal operation. "Tickling" is accomplished by writing to one of the gate array control registers. The tickle signal from U61 is output as a test signal on pin 1 of U62.

During a discharge sequence, the main control processor turns on the patient control signal PATRLY (pin U62-61) to close the patient relay, then programs the tickle/reset circuit for a long (44.8 ms) reset pulse, and stops tickling. Because of the relay's mechanical delay, the processor goes into reset before the relay closes. The processor is held in reset, while the relay closes and the HV capacitor energy is discharged through the patient. This protects the processor's internal registers during the relay closure, which is a time of high electrical interference. Also, the processor is brought up in a known state after the discharge.

When the processor comes out of reset after the discharge, it tickles rapidly for 25 ms, and then performs an A/D conversion of the peak discharge current signal IPEAK. A second conversion of IPEAK is done (at 4x gain) if the signal at unity gain was less than 1.2 volts. These peak current samples are used for calculating the delivered energy for self-test discharges. Afterwards, the patient relay control signal PATRLY (pin U62-61), and the safety relay control signal SFTYRLY (pin U62-59) are turned off to open the patient relay and close the safety relay. The processor then waits for CONRST to go high again, and hold it in reset while the safety relay closes. This second long reset protects the processor from any electrical interference that might occur on the closing of the safety relay. This electrical interference can be significant if an open paddles discharge occurs.

After coming out of the second long reset, the processor tickles rapidly for 25 ms, and then resumes normal operation. See Figure 2-7.

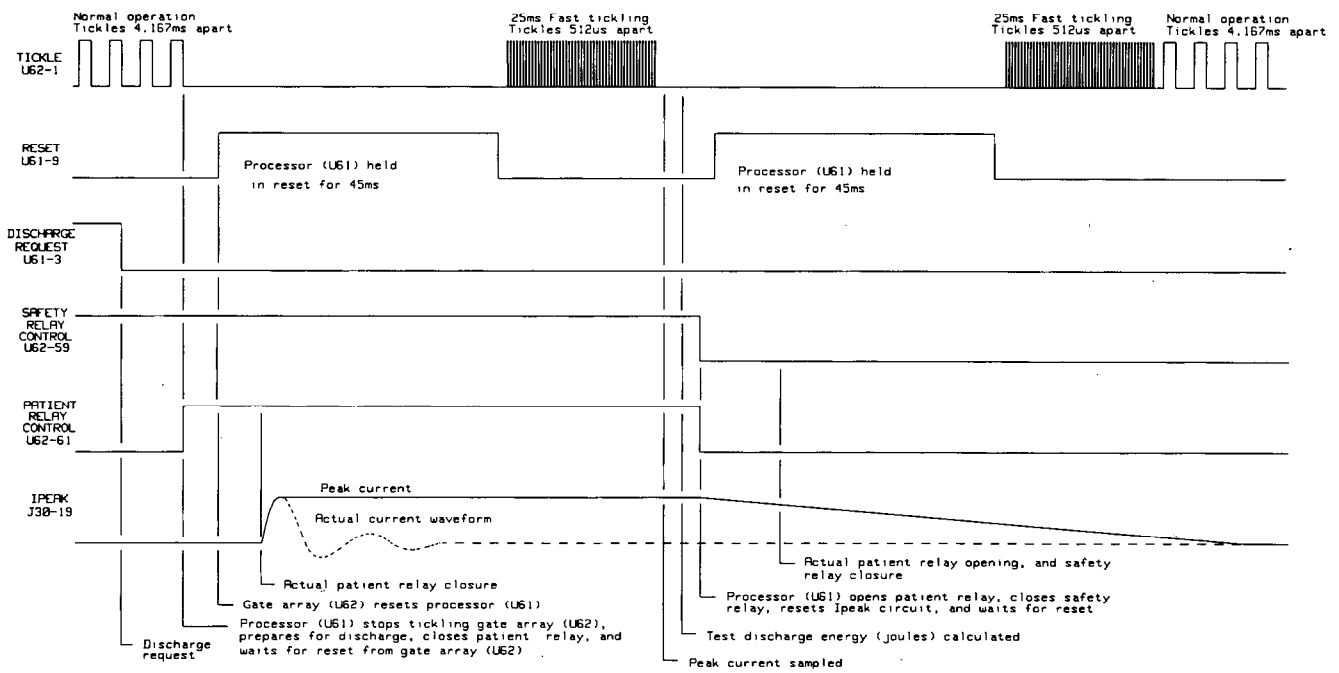


Figure 2-7. Tickle/Reset Timing Diagram.

2-15. HV CAPACITOR CHARGE AND DISCHARGE

The processor reads the energy select switch in through P2.0-P2.3 (pins 21-24 of U61) every 4.167 ms software cycle. The energy select switch must remain at the same setting for 500 ms, before it is used as the selected energy for charging the HV capacitor. Charging is initiated by pressing the front panel charge switch, or the paddles charge switch. At the beginning of a charge, U61 begins displaying the HV capacitor energy on the display in real time.

The processor turns on the safety relay control signal (pin 59 of U62) by writing to one of the gate array control registers, and then waits 50 ms for the safety relay to open. The processor then selects a pulse width (or charge rate) and turns on the charge rate control signal CHGFREQ (pin U62-60) via the control registers. At the same time, the charge enable signal CHGENBL (pin U61-6) goes low to enable the High Voltage Charger circuitry.

NOTE

UNDER LOW BATTERY CONDITIONS, CHGFREQ MAY TURN OFF, AND CHGENBL MAY GO HIGH PERIODICALLY TO ALLOW THE BATTERY VOLTAGE TO RECOVER BEFORE CONTINUING THE CHARGE. THIS MAY INCREASE DEFIBRILLATOR CHARGING TIME.

The charge is completed when the energy on the HV capacitor reaches the selected energy setting. CHGFREQ is disabled and CHGENBL returns high to stop the HV Charger circuitry. The charge done tone CHGTONE (pin U62-23) is enabled. Transistors Q3 and Q4 are turned on by P1.1 going high, to light the charge done LED in the apex paddle; and P2.6 goes high to turn on the front panel charge done LED. Periodically CHGFREQ and CHGENBL may be activated to refresh the energy on the HV capacitor; and keep it charged to near as possible the selected energy setting. The HV capacitor will remain charged for 60 seconds after the charge is completed. At the end of 60 seconds, the processor will close the safety relay and dump the charge internally through the safety resistor. During the last 10 seconds, the charge done tone is intermittent to warn of this impending internal dump.

After the charge done tone comes on, the processor waits 125 ms before it begins checking for the discharge request signal (pin U61-3) to go low. The low indicates that both paddles discharge switches were pressed at the same time. When this signal is detected, the processor turns on the patient relay control signal to close the patient relay, and waits for a reset from the tickle/reset circuit. The tickle/reset circuit holds the processor in reset for 45 ms, while the energy is being discharged through the patient. After coming out of reset, the processor samples the peak discharge current signal (IPEAK) and calculates the delivered energy if it was a test discharge. The processor then turns off the patient relay control signal and the safety relay control signal; to open the patient relay, and close the safety relay. The processor then waits for another reset, and is held in reset for 45 ms again, while the safety relay closes. After this second reset, the processor resumes normal operation. After a discharge or internal dump, the processor will continue to display the HV Capacitor energy in real time for 10 seconds or until the energy decreases to less than one Joule, which ever occurs first. After a self-test discharge, the energy delivered to the 50 ohm test load is flashed 3 times on the display.

2-16. SYNCHRONIZED CARDIOVERSION

For synchronized cardioversion, the charge and discharge sequence is the same except that the patient relay drive is not actviated until an R-wave is detected by the synchronizer. The synchronizer is software implemented in the control processor, U61. In SYNC mode operation, the processor filters the digitized ECG/Sync input signal and looks for the R-wave, or leading edge of a Sync pulse, to synchronize the discharge. When in SYNC mode, the sync LED on the front panel is turned on and with each R-wave or Sync pulse detected the LED flashes off for about 180 ms. This flash is also accompanied by a beep from the speaker circuit.

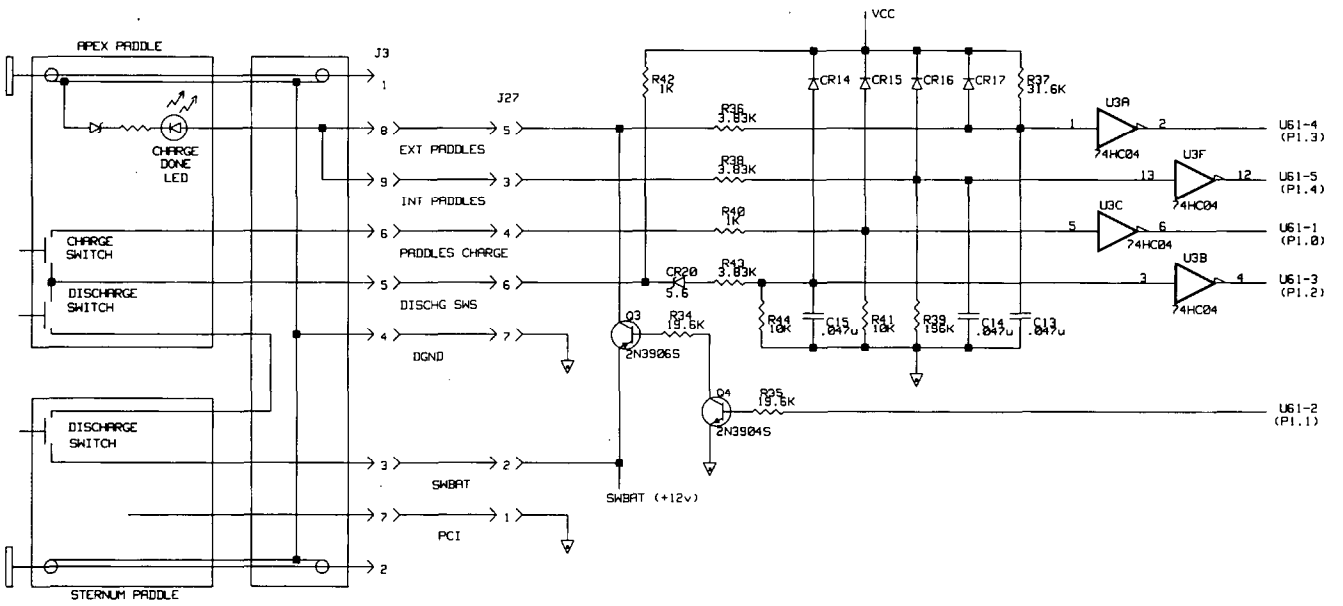


Figure 2-8. Paddles Status.

2-17. PADDLES STATUS

Several signals from the paddles are input to the Control board, and used by the control processor. See Figure 2-8.

The signal DISCHG SWS (J27-6) indicates when the discharge switches are both pushed. When the switches are open, the signal is pulled to +5 volts through R42; and when closed, the signal is pulled to +12 volts (SWBAT). CR20, CR14, R44, and R43 provide logic level translation, before the signal is input to inverter U3B. The output of this inverter is input to P1.2 of U61. A low level at P1.2 indicates the discharge switches are closed.

When the charge switch is closed, the signal PADDLES CHARGE (J27-4) is connected to DISCHG SWS, and is pulled to +5 volts through R108. When the switch is open, PADDLES CHARGE is at ground. The signal is input to U3C, and the output of U3C is input to P1.0 of U61. A low level at P1.0 indicates the charge switch is pressed. R41, R40, and CR15 provide overvoltage protection for U3C in case the charge and discharge switches are both closed.

Signals INT PADDLES (J27-3) and EXT PADDLES (J27-5) are used to determine whether a paddles set is plugged into the instrument; and also, whether the paddles are internal or external paddles. INT PADDLES is pulled to ground through R39 and EXT PADDLES is pulled to +5 volts through R37. These signals are input to P1.3 and P1.4 of U61, through inverters U3A and U3F.

Under normal conditions an external paddles set is connected to the instrument, and the signals are connected together. In this case, both signals are a logic high; and P1.3 and P1.4 are low.

If U61 detects that a paddles set is not connected, the defibrillator charge and discharge funtions will be inhibited. A charge in progress will be aborted, and the energy dumped internally. If U61 detects an internal paddles set is connected, the energy selection is software limited to 50 joules. Energy switch settings greater than 50 joules are interpreted as 50 joules.The signal EXT PADDLES is also used to light the charge done LED in the apex paddle. When the HV charge is done, P1.1 of the main control processor goes high and turns on Q4, which turns on Q3. With Q3 turned on, EXT PADDLES is pulled to +12 volts (SWBAT) and the charge done LED is turned on.

2-18. SYSTEM DIAGNOSTICS

The control processor performs diagnostic checks of the instrument each 4.167 ms software cycle. These checks are to verify that the unit is operational and can be safely charged and discharged. If an unsafe condition is detected, the processor will disable the charge and discharge sequences, and display error messages on the energy display. Error conditions that are checked include the A/D converter malfunctioning; the supply voltages out of specification; the safety relay circuitry stuck open or closed; and the HV capacitor overcharged, leaking, or arcing.

2-19. DISPLAY CONTROL AND POWER SUPPLY

The front panel energy display, and low battery, charge done, and sync LEDs are controlled by the processor. The three digit 7-segment energy display uses a multiplexed drive scheme as shown in Figure 2-10 of Section 2-21. Like segments of each digit are connected together to form an 8 (segment) by 3 (digit) array. Segment information is presented to each digit sequentially, and the digit is enabled. Each digit is turned on for one 4.167 ms software cycle, then the next digit is enabled. Thus, the refresh rate is 12.5 ms or 80 Hz. Segment control is accomplished through one of the gate array control registers, which acts as a latch. This latch is designated by P5.0-7, and is output on pins 43-46, 49, 52, 53, and 58 of the gate array (U62). The digits are enabled by P3.3, P3.4, P3.5 of the processor (U61). The energy display is used to display the deliverable energy, test energy, battery voltage (in service mode), and error codes. The low battery, charge done, and sync LEDs are enabled by P2.4, P2.5, and P2.6 of the processor.

A +8.4V power supply used by several of the LEDs is made up of U4, a three terminal adjustable regulator, on a heatsink. The voltage is set by R46 and R47; the output is bypassed and clamped by C26 and CR32, respectively.

2-20. MARKER PULSE CIRCUIT

Generation of a negative-going pulse on J26 pin 1 is initiated by a high logic pulse from U61. At that time C38, C39, and C40 have already been charged by SWBAT through CR26 and CR27. When Q8 turns on, the capacitor's positive terminals are pulled near ground; and the negative terminals turn on the common base Q4 stage, which sinks current from the output, see Figure 2-9. The marker pulse output is -10V, 12mS and less than 1.5mA.

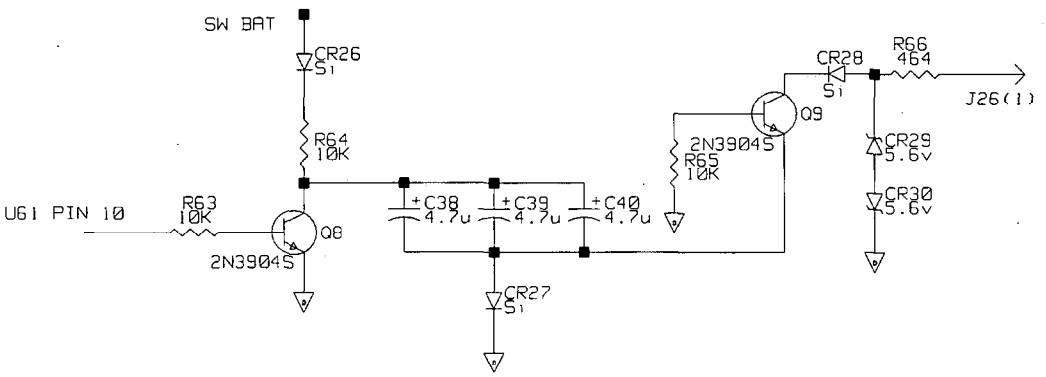


Figure 2-9. Marker Pulse Circuit.

2-21. DISPLAY BOARD

The three digit 7-segment energy display uses a multiplexed drive scheme as described in section 2-19 and depicted in Figure 2-10. U1 contains eight channels of transistors, configured in such a way that a logic one on an input will enable an output Darlington pair to source current from the 8.4V supply on pin 9 (see Figure 2-11.). U2 contains seven (one unused) channels of transistors configured so that that a logic one on an input will enable an output Darlington pair to sink current to ground (see Figure 2-12.).

The SYNC, CHARGE DONE, and LOW BATTERY LEDs are driven steady state. The BATTERY CHARGING and POWER ON LEDs are illuminated by current originating on the Battery Charger Board A4. The Display Board also serves to pass Front Panel Switches and Paddles In Place Switch information to the Control Board A7.

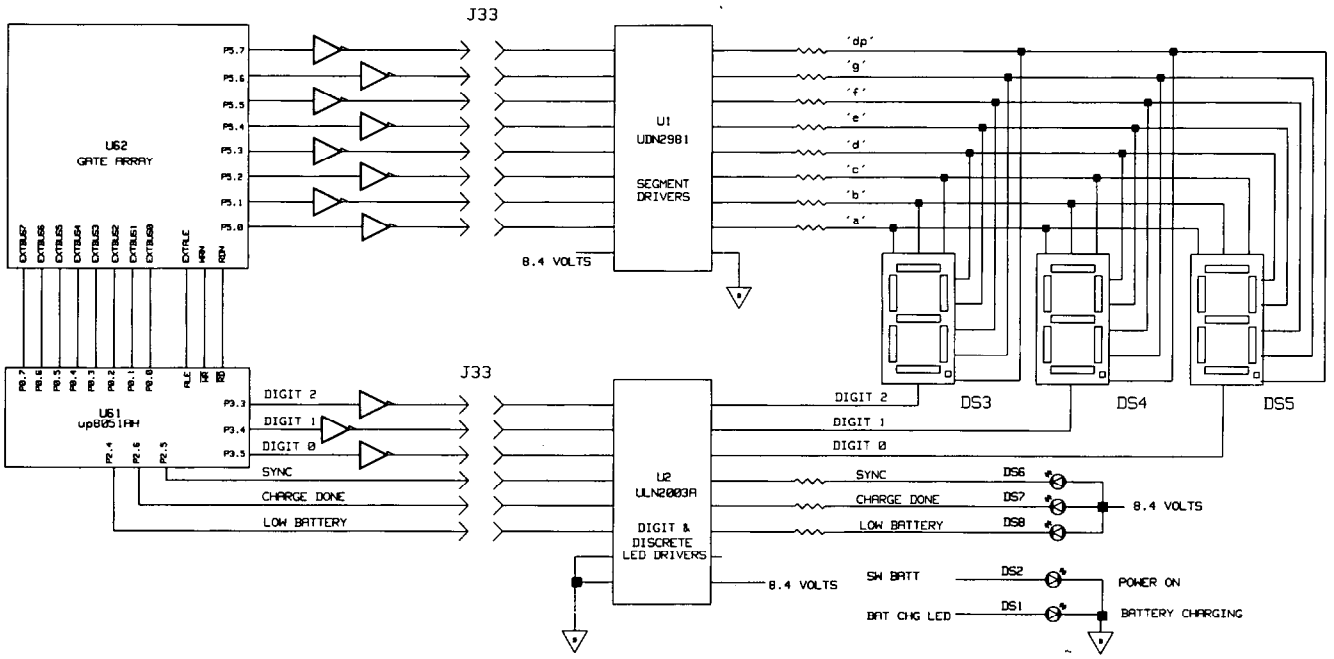


Figure 2-10. Display Control Circuit.

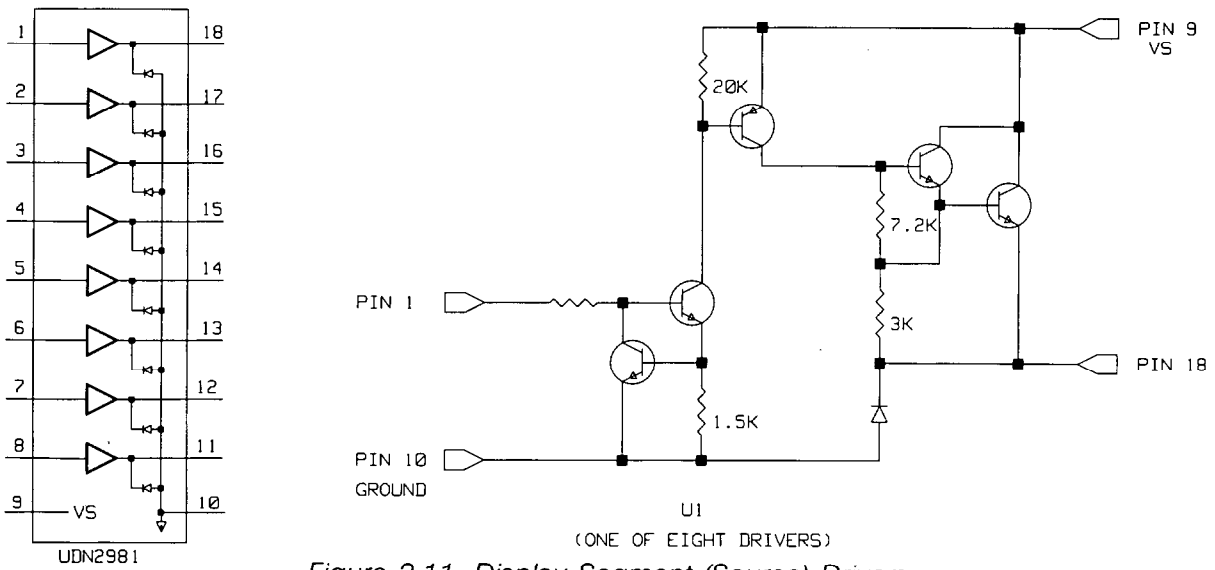


Figure 2-11. Display Segment (Source) Drivers.

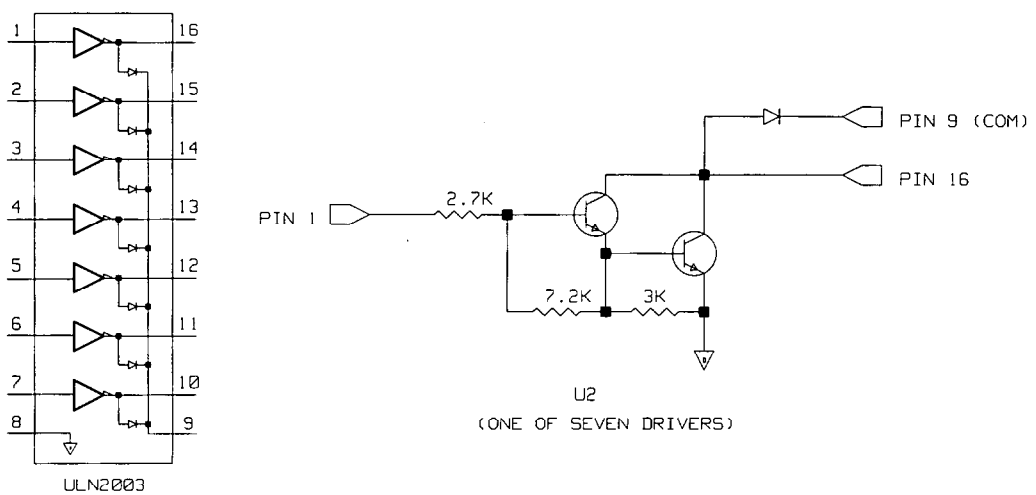


Figure 2-12. Display Digit and Discrete LED (Sink) Drivers.

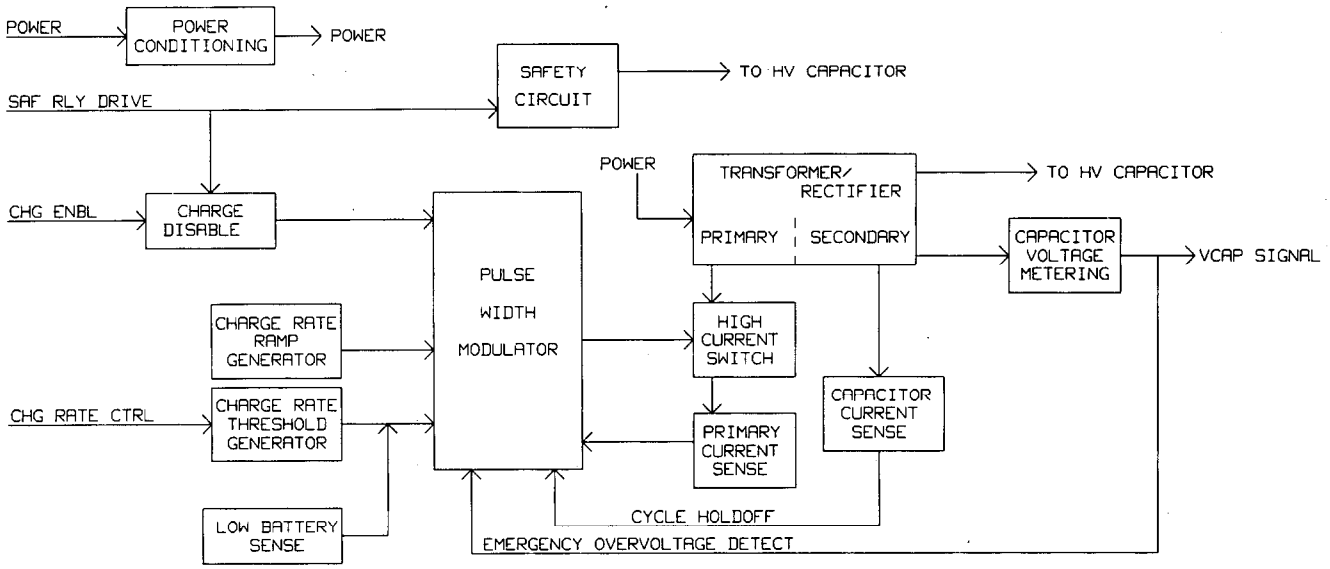


Figure 2-13. Power Supply Module.

2-22. HIGH VOLTAGE CHARGER BOARD

The interaction of the different blocks in Figure 2-13. will be described in this section. Then in following sections the circuitry in each block will be described in detail.

The High Voltage Charger Board operates as a variable frequency flyback DC- DC high voltage switching power supply for purposes of charging the HV Capacitor. Charging begins with reception of the proper SAF RLY DRIVE (safety relay drive, CHG ENBL (charge enable), and CHG RATE CNTL (charge rate control) signals from off-board. The Pulse Width Modulator, as the central controlling block, outputs a pulse the duration of which is dependent upon the time required for the Charge Rate Ramp to reach the Charge Rate Threshold. During this time the High Current Switch, a power MOSFET, is turned on; the result is a current ramp in the transformer primary. At the end of the Pulse Width Modulator output pulse duration the power MOSFET stops conducting, and the Transformer/Rectifier secondary conducts current onto the off-board Main Storage Capacitor. The Capacitor Current Sense circuit then detects current, which causes it to inhibit the restart of another Pulse Width Modulator output. When the capacitor current reaches zero, however, the Cycle Holdoff is released, and the entire cycle is repeated. Meanwhile the capacitor voltage is being scaled and buffered by the Capacitor Voltage Meter circuit for output to the Control Board. During all this time the Power Conditioning circuit provides bypassing for the Switched Battery input, and provides fusing and bypassing for the Raw Battery input; and the Safety Relay Drive input to the Safety Circuit operates to disconnect a shunt resistor from the HV Capacitor.

A number of signals and blocks serve as inputs to the Pulse Width Modulator block, to influence its output. The Charge Disable circuit uses the Safety Relay Drive input as well as the Charge Enable input to enable charging as appropriate. The Charge Rate Ramp Generator generates a voltage ramp which is slower when the battery voltage is lower, to partially compensate for otherwise slowed charging under low battery conditions. The charge rate is varied remotely by duty cycle modulation into the Charge Rate Control input which is received by the Charge Rate Threshold Generator circuit. This circuit also AC-couples the Charge Rate Control input to protect against an erroneous stuck-high condition. The Low Battery Sense circuit disables defibrillator charging if the battery voltage drops below 10 volts. The Primary Current Sense circuit monitors the Transformer/Rectifier primary current for a possible overcurrent condition, in which case the pulse width modulator would terminate its output pulse. Finally, the Pulse Width Modulator block receives the output from the Capacitor Voltage Metering circuit, to disable charging in the event of a runaway charge condition where the HV Capacitor reaches an unacceptably high voltage level.

2.23. POWER CONDITIONING CIRCUIT, (Figure 2-14)

High- and low-current battery and ground lines enter the HV Charger Board on separate lines. The ground lines are connected on the Battery Charger Board. The high-current battery line enters the HV Charger Board unfused and unswitched, and is fused by F1, which is mounted in FH1. It is then filtered by C8, a low ESR capacitor needed to supply the high current surges required in the primary circuit. The low-current battery line enters the HV Charger Board having been through a circuit breaker and through a relay controlled by the front panel switch. It is bypassed by C2 and C9 to low-current ground. The low-current ground is also used as an analog ground for the capacitor voltage indication which is returned to the Control Board.

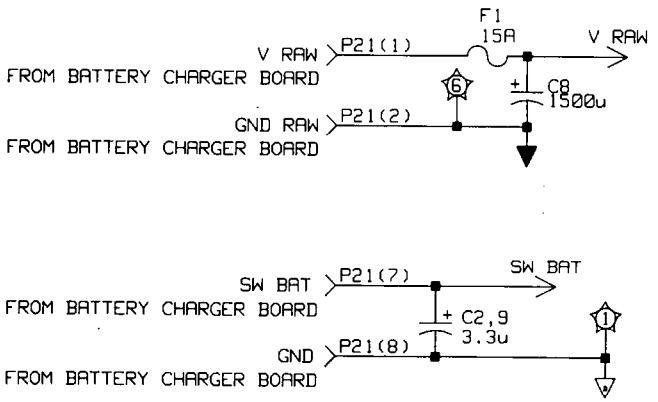


Figure 2-14. Power Conditioning Circuit.

2-24. SAFETY CIRCUIT, (Figure 2-15)

The defibrillator safety circuit is composed of K1, R1, CR1, C11, and R19. The Safety Relay Drive line is brought low by a relay driver on the Battery Charger Board, in response to a command from the Control Board. The high voltage relay K1 will then open, which disconnects R1 from the negative HV capacitor terminal. Upon command from the Control Board the line will be released and the relay will again close, allowing R1 to discharge the capacitor to zero or to some other value selected by the Control Board. Disconnecting power will also release the relay contacts into their normally closed position, safely shunting the HV capacitor terminals. Upon release of the Safety Relay Drive line, CR1 serves to augment the Battery Charger Board's diode clamping as protection from the K1 coil inductive spike. In addition, CR1 helps protect the driver circuitry from spikes that may be capacitively coupled through the relay when the opening or closing relay contacts undergo rapid voltage swings. C11 and R19 are relay contact snubber components that help to reduce the rate of voltage change across the contacts during contact opening or bounce, thereby reducing radiated and conducted noise.

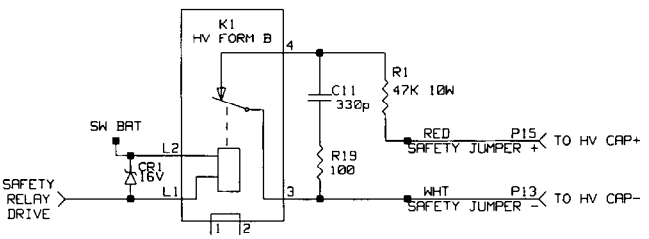


Figure 2-15. Safety Circuit.

2-25. PULSE WIDTH MODULATOR, (Figures 2-16A and 2-16B)

For this circuit implementation, the pulse width modulator can be seen in Figure 2-16B; a voltage source the output of which can be disabled by any one of five conditions; and a 5 volt reference. Figure 2-16A shows a more complete but less intuitive representation of the device; schematics of several of the internal functional blocks are available from manufacturer's catalogs.

The output stage is an emitter follower; so the output voltage will be slightly less than switched battery when the output is turned on, and will be floating when the output is off or disabled. Resistors R11 and R12 provide the only current sinking on the output. The 5 volt reference output is bypassed with C1.

There are five conditions which can cause the output to turn off:

1. If current is sourced into pin 10,
2. If the voltage at pin 7 is greater than that at pin 9,
3. If the voltage at pin 1 is greater than that at pin 2,
4. If a voltage greater than 3 volts is placed on pin 3,
5. If the voltage at pin 4 exceeds the voltage at pin 5 by 200 millivolts or more.

Any one of conditions 3 through 5 will also cause a Darlington transistor (internal to the Pulse Width Modulator) to pull the voltage at pin 7 down to about 0.8 volts above ground. It should also be mentioned that pin 9 is the output of a transconductance opamp in the Pulse Width Modulator, the inputs of which are pins 1 and 2. Pin 9 is a current source of about 100 microamps at essentially any time that the voltage at pin 2 is higher than that at pin 1 unless condition 5 is met as described above.

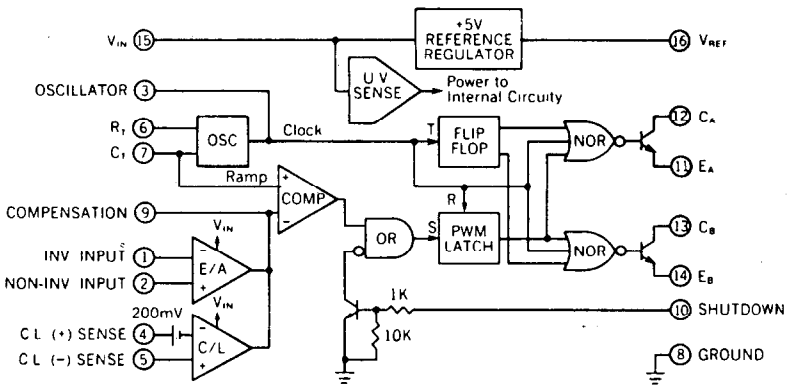


Figure 2-16A. Pulse Width Modulator.

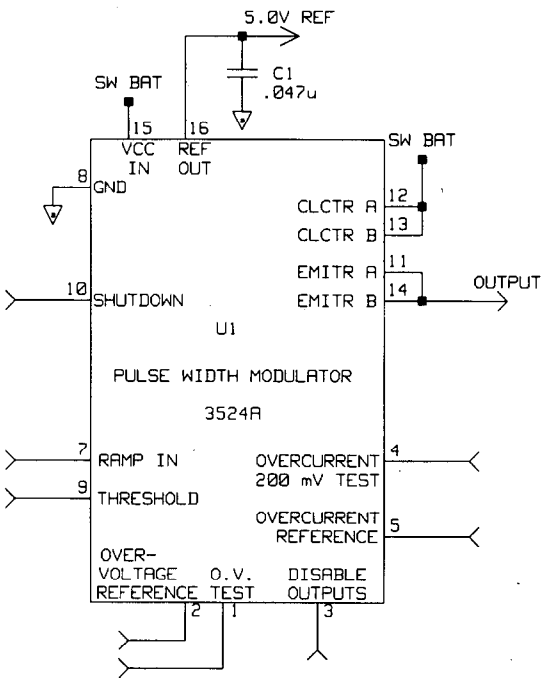


Figure 2-16B. Pulse Width Modulator.

2-26. CHARGE DISABLE CIRCUIT, (Figure 2-17)

R2, CR2, and CR3 form the charge disable circuit. In order for the charger to operate, the Charge Enable input must be brought low, and the safety relay must be driven. The diodes provide the OR function for disabling charge, as well as improving the logic zero voltage margin from the off-board signals.

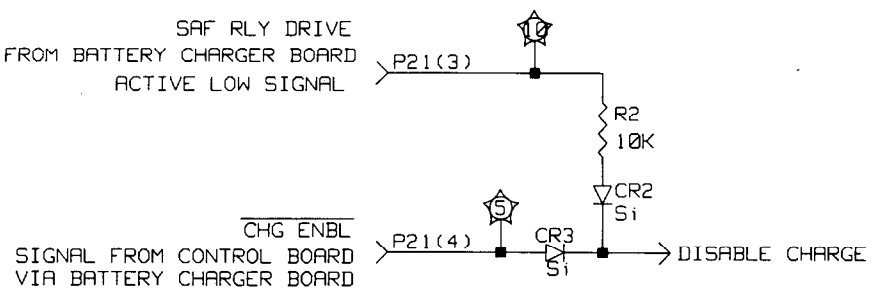


Figure 2-17. Charge Disable Circuit.

2-27. RAMP GENERATOR CIRCUIT, (Figure 2-18)

R3 and C3 form the Ramp Generator circuit. The exponential voltage rise is terminated after only a few volts excursion, when it reaches the voltage at pin 9 or when any of the other conditions described in the Pulse Width Modulator section are met; so the ramp is approximately linear. When the battery voltage is lowest, the ramp is the slowest, increasing the T1 primary on-time in partial compensation for decreased primary voltage.

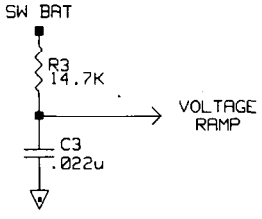


Figure 2-18. Ramp Generator Circuit.

2-28. CHARGE RATE THRESHOLD GENERATOR CIRCUIT, (Figure 2-19)

The components that form the Charge Rate Threshold Generator are C4, CR4, R4, R5, C5, U2C, R6, and CR5. The Charge Rate Control signal from the Control Board is a 15.6 kHZ, variable duty cycle, logic level square wave. A higher duty cycle yields a higher charge rate threshold, which will cause a faster charge. C4 and CR4 AC-couple and rectify the Charge Rate Control signal so that if the incoming signal is erroneously stuck high, the charge rate threshold will go low. R4, R5, and C5 filter the AC component from the resulting signal. U2C buffers that averaged value, and R6 overcomes the high output impedance that may result from the op amp's operation near ground. CR5 assures that the output of U2C will only sink current from U1 pin 9, allowing either U1 or U2B to pull pin 9 low.

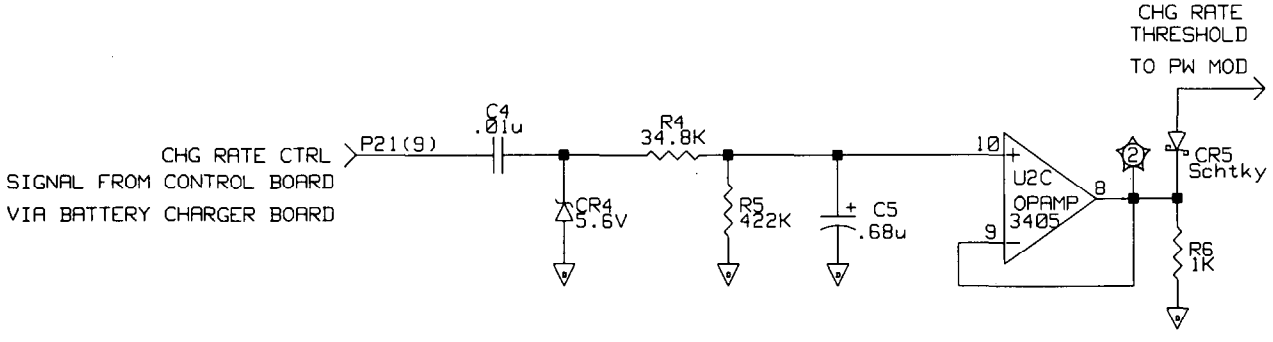


Figure 2-19. Charge Rate Threshold Generator Circuit.

2-29. LOW BATTERY SENSE CIRCUIT, (Figure 2-20)

R7 and R8 divide the battery voltage in half; C6 filters the divided voltage. If the resulting voltage drops below 5 volts, i.e., if the battery voltage drops below 10 volts long enough, then the output of U2B will sink current and thus disable the output of U1 as described in the Pulse Width Modulator section above.

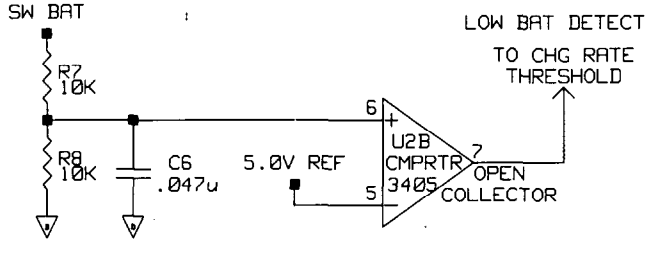


Figure 2-20. Low Battery Sense Circuit.

2-30. HIGH CURRENT SWITCH CIRCUIT, (Figure 2-21)

A high output from the pulse width modulator turns on the high current switch, Q1, which is a power MOSFET. Upon removal of the high output from the pulse width modulator, R11 and R12 will bleed off the gate charge, turning off the power MOSFET. If the drain voltage approaches an unsafe value for the device, CR6 will pull up on the gate voltage, so that the MOSFET will turn on and keep the drain voltage to a safe value. CR7 inhibits conduction of CR6 when the MOSFET switch is turned on. CR8 protects the device from spurious transients which could damage the gatesource junction. The MOSFET is mounted on a heatsink to keep it cool. The heatsink is electrically at the drain potential.

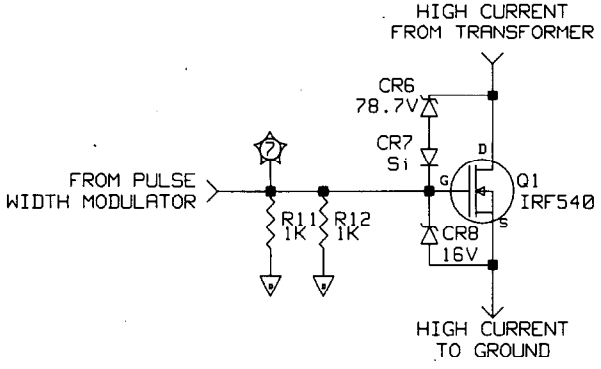


Figure 2-21. High Current Switch Circuit.

2-31. PRIMARY CURRENT SENSE CIRCUIT, (Figure 2-22)

R10, R9, and C7 form the Primary Current Sense circuit. The voltage across the current measuring resistor R10, a low inductance resistor, is directly related to the primary current. R9 and C7 filter from the signal high frequency components which are due to various primary and secondary circuit parasitic capacitances and stray inductances, including the secondary capacitance ringing reflected as mentioned in the Transformer/Rectifier description below. In addition, R9 and C7 attenuate the signal slightly in order to allow the primary current to ramp higher than would otherwise be possible with worst case component tolerances.

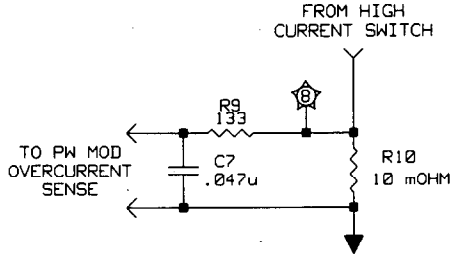


Figure 2-22. Primary Current Sense Circuit.

2-32. TRANSFORMER/RECTIFIER CIRCUIT, (Figure 2-23)

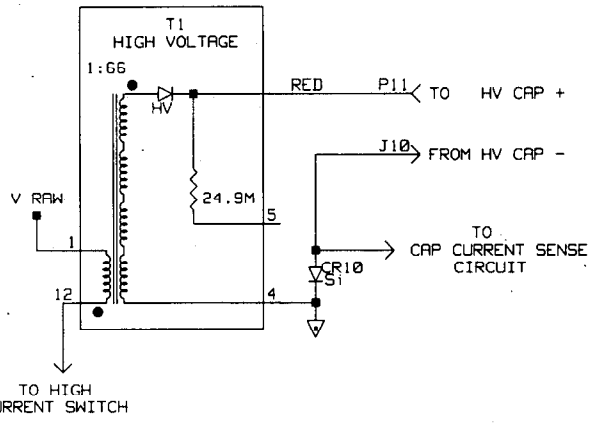


Figure 2-23. Transformer/Rectifier Circuit.

The Transformer/Rectifier circuit involves four of the five parts in T1: the primary winding, the secondary winding, the core, and the high voltage rectifier. The metering resistor, also part of T1, is discussed as part of the Capacitor Voltage Metering circuit.

When the high current switch Q1 turns on, approximately full battery voltage is applied across the primary winding. The high voltage rectifier is then reverse-biased; the rectifier anode is at a negative voltage approximately equal in magnitude to the battery voltage times the turns ratio (66). The constant voltage across the primary inductance, then, causes a constant slope current ramp in the primary circuit. When the high current switch Q1 turns off, the flux in the core of T1 causes current to flow in the secondary winding. The secondary voltage rises rapidly until the high voltage rectifier becomes forward-biased. At that time current is conducted into the HV capacitor positive terminal. The initial rectifier current is related to the ending primary current by the transformer turns ratio; and, because the secondary inductance is held at a near-constant voltage (approximately equal to the HV capacitor voltage), the current ramps down nearly linearly with time. Cessation of current is detected by the Capacitor Current Sense circuit, and the primary-secondary cycle is repeated. Note that when the HV Capacitor is at a high voltage, the secondary conduction time is less than when it is at a low voltage; hence the variable frequency capacitor charging.

It should be noted that a number of parasitic capacitances and stray or leakage inductances have an effect on the voltage and current waveforms. For example, when the power MOSFET switch turns off, the flux that is not coupled to the secondary winding will cause the MOSFET drain voltage to go higher than would be calculated by reflecting the secondary voltage back to the primary. The actual voltage depends on the amount of parasitic capacitance available for energy storage, and

on the amount of energy that is dissipated by such resistive losses as the MOSFET during switching. Another parasitic capacitance that plays a significant role is the interwinding secondary capacitance. When the MOSFET stops conducting and the secondary starts conducting, the rise time of the secondary voltage is limited by the relatively constant secondary current that is charging secondary stray capacitances. Then at the end of the secondary conduction portion of the cycle, when the high voltage rectifier becomes reversebiased, the secondary capacitances will ring with secondary stray and leakage inductances, and with reflected impedances from the primary. This ringing can continue during the entire primary conduction time. It will couple magnetically into the primary circuit; and will couple capacitively, via the capacitances of the high voltage rectifier's reverse-biased junctions, into the Capacitor Current Sense circuit.

2-33. CAPACITOR CURRENT SENSE CIRCUIT, (Figure 2-24)

Current from the HV Capacitor negative terminal, which flows during the time the rectifier in transformer T1 is forward- biased, flows to the transformer secondary through diode CR10. At that time U1 pins 11 and 14 are low, so that R13 serves to reduce the voltage that would otherwise be produced by R14 and R15. The CR10 diode voltage is then greater than the resulting voltage on U2A pin 3, so the output of U2A is open. R16 and the emitter follower Q2 then drive U1 pin 3 high, inhibiting the pulse width modulator output from going high. When current in the capacitor ceases, the voltage across CR10 becomes less than that at U2A pin 3, and the cycle hold-off signal at U1 pin 3 goes low. At that time the pulse width modulator output, U3 pins 11 and 14, will go high, which raises the voltage on U2A pin 3 by way of R13. During this time, some current will flow alternately in CR9 and CR10 due to the high voltage rectifier's capacitive coupling of transformer secondary ringing as described in the transformer/rectifier section above. The output of U2A will not toggle, however, because of the increased threshold on pin 3 during primary conduction.

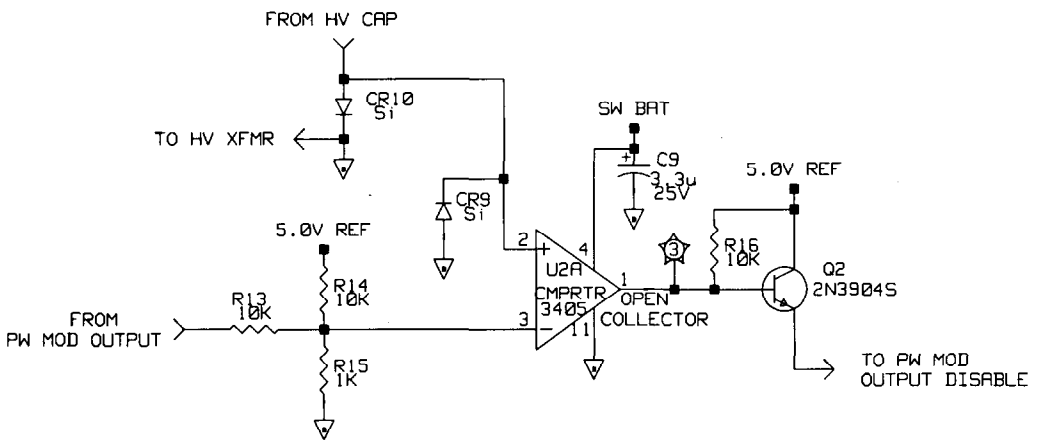


Figure 2-24. Capacitor Current Sense Circuit.

2-34. CAPACITOR VOLTAGE METERING CIRCUIT, (Figure 2-25)

Transformer T1 contains a resistor connected on one side to the high voltage rectifier cathode, which is at the HV capacitor voltage. The other side comes out of T1 on pin 5, and connects on the PC board to R17, which serves to divide the voltage down to a voltage under 5 volts. C10 filters any noise, and U2D buffers the voltage. CR11 protects U2D from any positive or negative spikes that may enter the board at that point, and R18 helps to maintain low impedance on the Vcap line. The capacitor voltage indication is sent to the Control Board for its use in determining the defibrillator's state of charge, and also to U1 pin 1, which will disable charging in the event that the capacitor voltage indication reaches an unacceptably high value of 5 volts.

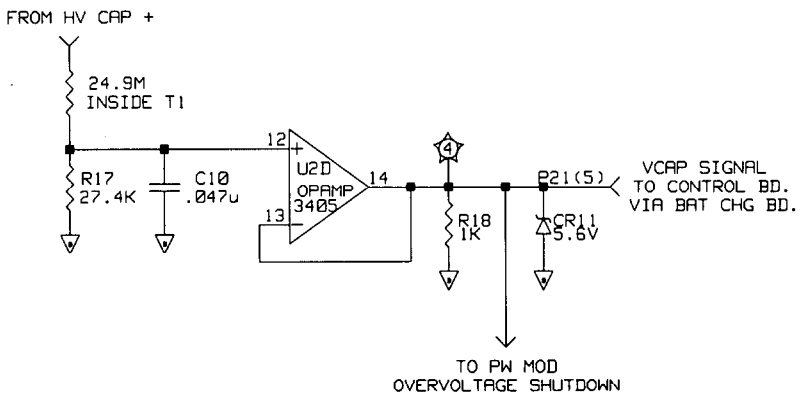


Figure 2-25. Capacitor Voltage Metering Circuit.

2-35. HIGH VOLTAGE CIRCUITRY

High Voltage Circuitry functions to store energy during defibrillator charging; and to switch, waveshape, and measure energy during defibrillator discharging. The patient is isolated from the High Voltage Charger Board and from the HV Capacitor at all times except during discharge; the charging circuit is isolated from the HV Capacitor and from the patient during discharge. A resistive load is provide for test discharges.

2-36. HV CAPACITOR CHARGE CIRCUIT, (Figure 2-26)

The HV Capacitor Charge Circuit is composed of the High Voltage Charger Board A5; the HV Capacitor A1C1; and the Patient Relay A1K1. The Defibrillator Charger Board supplies the energy needed to charge the HV Capacitor, and also supplies a shunt resistive load to dump charge when needed. The HV Capacitor includes a 24.9 megohm bleeder resistor as well, to preclude a buildup of charge when the High Voltage Charger Board is disconnected from the circuit. The Patient Relay is a double-pole, double-throw, high voltage, high surge current relay. The relaxed position of the relay is shown.

2-37. HV CAPACITOR DISCHARGE CIRCUIT (Figure 2-26)

The HV Capacitor discharge circuit is composed of the HV Capacitor A1C1; the Patient Relay A1K1; the HV Inductor A1L1; the Current Transformer A1T1; and the Test Load Resistor A1R1.

When the 12 ohm coil of the Patient Relay is supplied with current by the Battery Charger Board A4, the relay contacts A1K1a and A1K1b will switch from the normally closed position to the normally open position. The RF chokes included in the relay assembly help to suppress EMI from high-energy arcing of the contacts. The HV Inductor provides smoothing of the current waveform to meet specified parameters; in addition, its 11 ohms of winding resistance provides energy dissipation in the event that the defibrillator is discharged into a low external impedance. The Current Transformer divides the discharge current by a factor of 2500, for use by a peak detector on the Analog ECG Board A6. The Test Load Resistor is available between the paddles' pockets, for use in simulating a discharge into a 50 ohm patient.

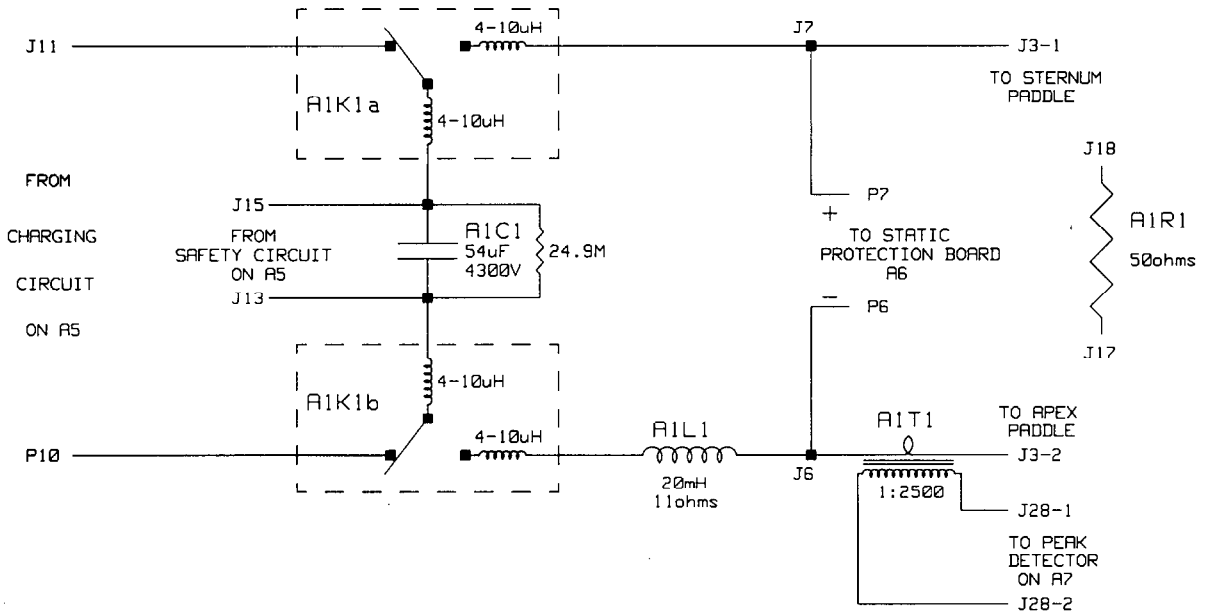


Figure 2-26. Capacitor Discharge Circuit.

2-38. STATIC PROTECTION BOARD

The static protection board provides a high resistance (low current) leakage path to ground. This path is necessary to bleed off any electric charge that builds up on the paddles due to the stray capacitance (approximately 600 pF) of the paddles cables. This charge could be due to electrostatic charge, and/or an open discharge of the instrument.

High voltage diodes CR1 and CR2 isolate this bleeder circuit from the paddle electrodes during the normal discharge sequence of the instrument. Refer to Figure 2-27.

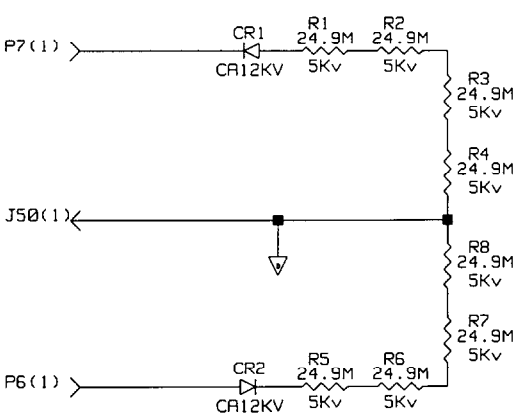


Figure 2-27. Static Protection Board.

2-39 BATTERY CHARGER AND LOW VOLTAGE POWER SUPPLIES.

The 43100-6016X (A3) and 43100-6014X (A4) PC assemblies comprise the power supplies for general use in the defibrillator. The 43100-6014X has the off-line switcher and other low voltage supplies. The 43100-6016X has only circuit breakers and several line filter chokes.

A 12V battery pack powers the instrument. The off-line switcher charges this battery at 14.25V@25°C/3A max. A combination of linear and switching regulators run off this battery to provide DC supplies for the rest of the defibrillator. Battery power is supplied directly to the HV Defibrillator Charger Board (A5) through a fuse on the Power Supply Board (A4), but battery power is connected to other circuits and the regulated supplies (+5V, +8V, and -4.4V) via a low voltage shutdown circuit.

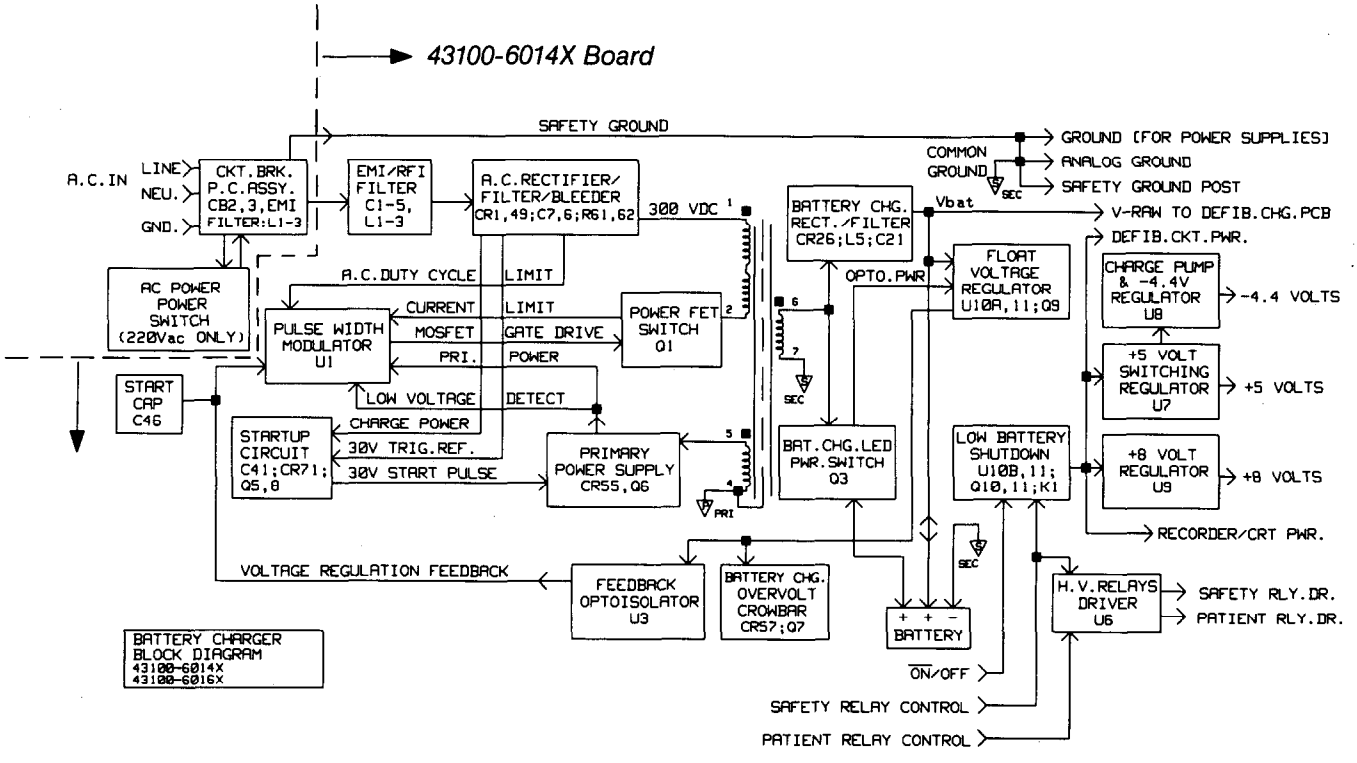
Figure 2-28 is a block diagram of the PC assemblies A3 and A4, showing flow of power.

2-40 LINE FILTERING AND RECTIFICATION (Figure 2-29).

WARNING

PRIMARY COMMON IS ONLY A COMMON POINT OF REFERENCE ON THE PRIMARY SIDE AND IS 'HOT' WITH RESPECT TO SECONDARY GROUND OR EARTH GROUND. WHEN WORKING WITH THIS CIRCUIT, DO NOT TIE PRIMARY COMMON TO EARTH GROUND OR TO YOUR SCOPE GROUND OR DAMAGE WILL RESULT.

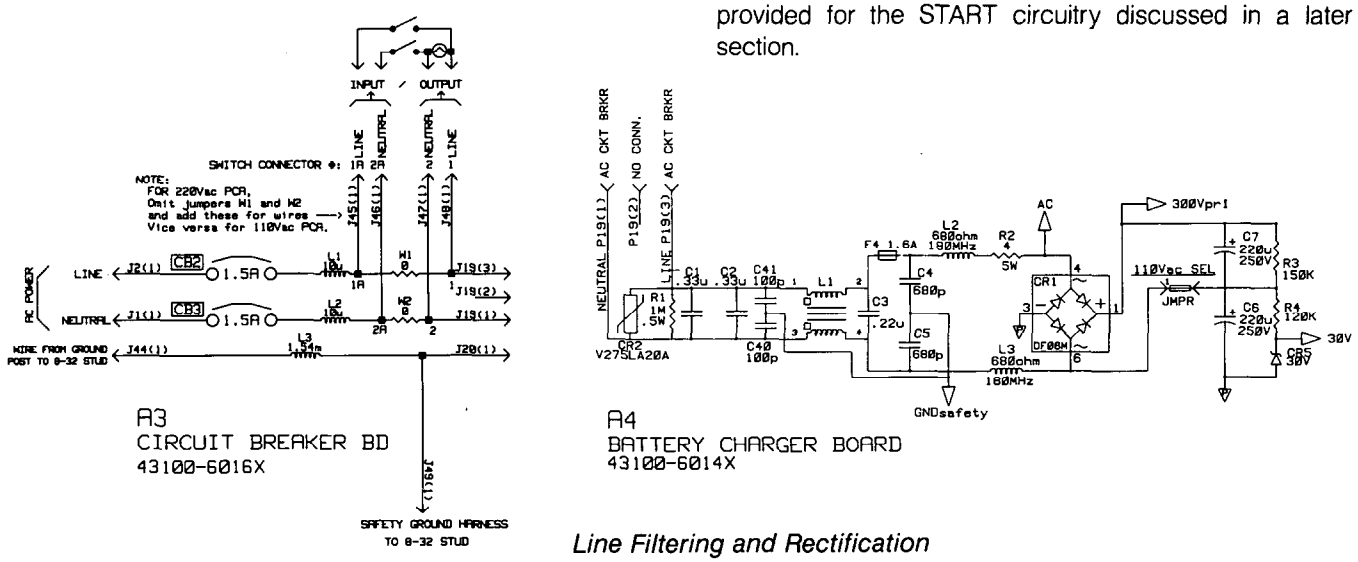
The AC power cord connects at the Circuit Breaker Board. LINE and NEUTRAL go through EMI suppression inductors L1 and L2 to the Battery Charger Board. They either go directly in the 110Vac models or via the ON/OFF DPST power switch in the 220Vac models. Power cord EARTH GROUND connects to the ground post, which is also connected to the left side of EMI inductor L3 (see Figure 2-29) on the Circuit Breaker Board. The right side of L3 branches off to the Battery Charger Board and becomes the low voltage power supplies (secondary) ground. It also goes via green/yellow safety ground wires to the recorder frame, ECG output jack, and volume adjust potentiometer frame.



Power Supply/Battery Charger Block Diagram
Figure 2-28.

On the Battery Charger Board, line filters attenuate conducted and radiated EMI from the off-line switcher and digital circuitry to conform with regulatory standards. Circuitry is also protected from incoming EMI by the same components. L1-3 and C1-5 form common-mode and differential-mode filters. L2 and L3 remove the higher frequencies (above 30MHz) by turning into lossy, resistive elements. Countries choose C4 and C5 to conform with their limit of ground leakage current. R1 discharges C1, C2 and C3 when AC power is removed. A metal cage surrounding the off-line switcher also confines EMI. This is a standard 110/220Vac rectification circuit. For 220Vac, jumper W1 is left out. CR1 performs fullwave rectification to produce a DC output. For 110Vac, W1 is loaded, which reconfigures the circuit into a voltage doubler, with only half of CR1 being utilized. In either case, 300Vdc nominal appears across series storage capacitors C6 and C7. R2 (4 ohms/110Vac or 8 ohms/220Vac) limits the inrush current through CR1. Fuse F4 is used to limit the damage if a short should occur in primary components such as CR1 or Q1.

Bleeder resistors R3, R4 and zener CR5 remove the imbalance which would otherwise occur if C6 and C7 have unequal leakages. Also, they discharge the storage caps when AC power is disconnected. A 30V reference is also provided for the START circuitry discussed in a later section.

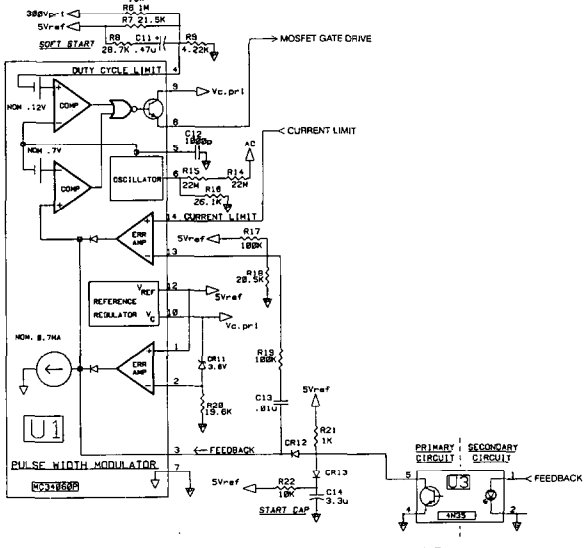


Line Filtering and Rectification
Figure 2-29.

2-41 PULSE-WIDTH MODULATOR IC (Figure 2-30).

U1 is an off-line switcher Pulse-Width Modulator (PWM) IC. This IC (output pin 8) controls the switching device, such as the GATE of a MOSFET, in a switching power supply. With a built-in 5V reference (pin 2) and ERROR AMPLIFIERS for feedback, the power supply can be highly regulated even under fluctuating input conditions. It has an oscillator whose frequency can be determined by a single capacitor and resistor.

The analog signals at pin 3 and pin 4 regulate the pulse-width, that is, the duty cycle. Signals at these pins are compared with the sawtooth pattern at pin 5 to derive the digital output at pin 8. Because of the internal NOR gate, the duty cycle is INVERSELY related to the voltage at pins 3 and 4. That is, duty cycle reduces from a maximum of 95/to 0/ with either pin 4 increasing from nominal 0 to 2.9V or pin 3 increasing from nominal 0.7 to 3.7V. Multiple sources are 'wire-ORed' together in the control of reducing duty cycle: (a) Outputs from the comparators feed into an OR gate with a trailing INVERTER (i.e., the NOR gate), (b) FEEDBACK from the secondary via optoisolator U3 and the two ERROR AMPLIFIERS are 'diode-ORed' together, including the use of CR12.



Pulse-Width Modulator IC
Figure 2-30.

U1 nominally operates at 42KHz. This is set by C12 and R16. R14 and R15 are tied to the AC line, and this effectively FM modulates the clock by nominal +/- 1KHz at the rate of line frequency, 50/60Hz.

R6, R7 and R9 set the DEAD TIME CONTROL limit at pin 4 of the PWM, that is, it limits the maximum duty cycle for fault conditions. Under normal operating conditions, pin 4 is below the controlling level while pin 3 is in dynamic control. A pseudo-fault condition occurs at power-up when START CAP C14 holds pin 3 low. While there is no dynamic feedback, the SOFT START transient (via R8 and C11) momentarily raises the DEAD TIME CONTROL voltage to further limit the duty cycle. The voltage at pin 4 includes a sample of the rectified line voltage, 300Vpri, through R6. This permits a higher duty cycle limit at lower AC line voltage, since longer ON time is required to provide the same energy transfer. The opposite is true for higher AC line voltage.

It is undesirable to turn on the MOSFET Q1 when the primary supply voltage is low because an insufficient GATE DRIVE may place the MOSFET into moderate conduction and destroy the transistor by overheating it. This is preventable if the PWM is disabled when Vc.pri is below 8.6V. Detection of Vc.pri below 8.6V is done by comparing 5V reference with Vc.pri minus 3.6V (CR11, R20).

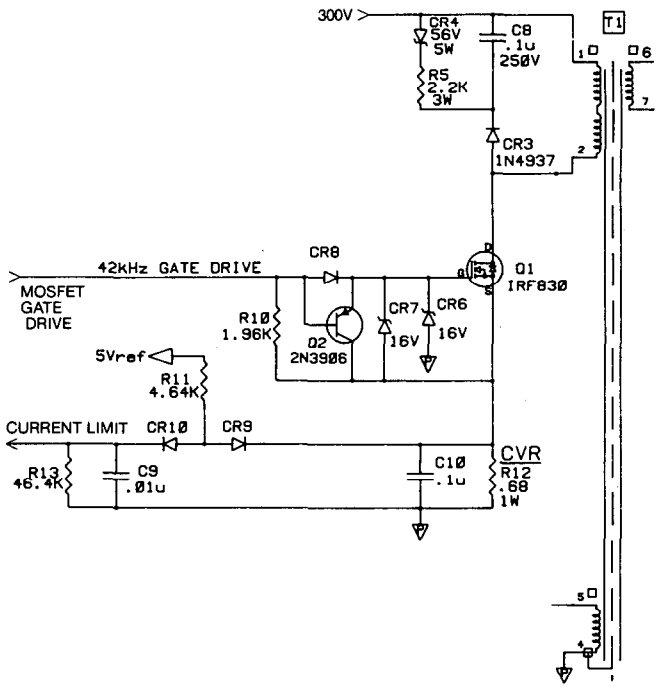
As previously stated, C14 is the START CAP. At start-up, C14 holds pin 3 low in requesting power for the secondary circuit before the secondary enables and makes the request. CR13 isolates the START CAP after it is charged and R22 discharges it when AC power is removed. This feeback loop, which includes the optoisolator, regulates the ouput voltage.

The output current is regulated by another loop. Output current on the secondary side is reflected back to the primary side at the turns ratio of transformer T1, 3:1, Primary:Secondary. R12 senses current on the primary side (Figure 2-31). Duty cycle is cut back when the peak current equals the threshold set by R17 and R18. R19 and C13 compenate this CURRENT LIMIT loop.

2-42 MOSFET SWITCH AND CURRENT SENSING (Figure 2-31).

The PWM U1, with an NPN emitter follower for output, can adequately drive the MOSFET switch Q1 ON (through CR8). However it needs a pull-down circuit (Q2 and R10) for rapid turn-off. Since this is a forward converter, as Q1 turns OFF, the magnetizing current flows through a snubber formed by C8, CR4, and R5 as the DRAIN flys up to about 350 to 450V. CR6 and CR7 provide GATE protection for Q1.

R12 is a Current Viewing Resistor (CVR) and C10, high frequency bypass. Peak current is detected by CR9, CR10, C9, R13 and R11 and fed back to U1. The very fast noise spikes on the CVR, however, will not appear on the peak detector because of the relatively slow time constant of R11 and C9.

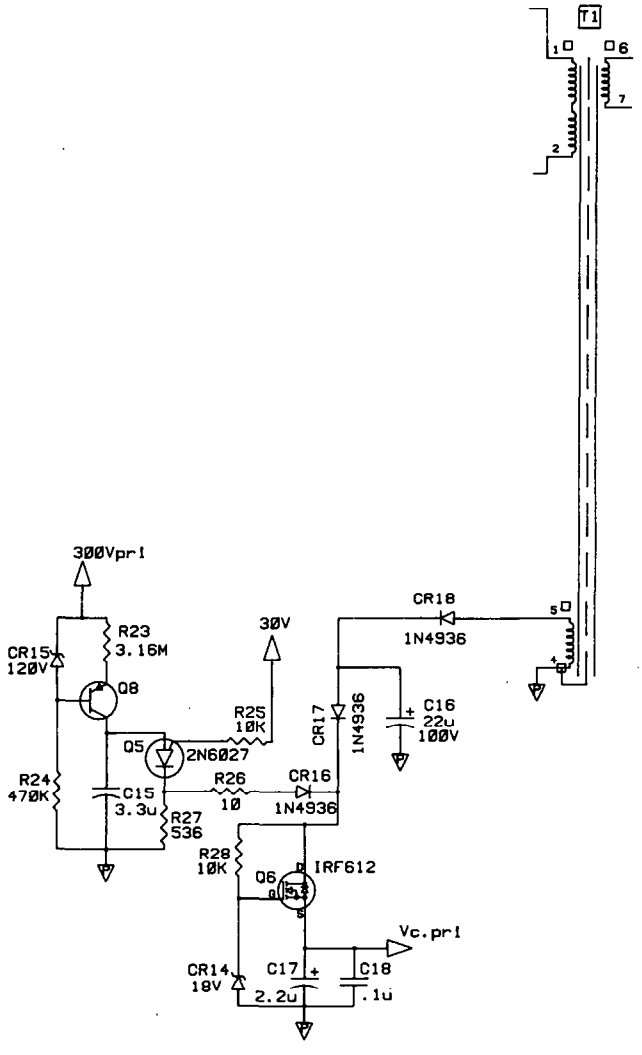


Mosfet Switch and Current Sensing
Figure 2-31.

2-43 PRIMARY CIRCUIT POWER (Figure 2-32).

Programmable Junction Transistor (PUT) is a PNPN device that complements an SCR. When the ANODE-GATE junction is forward biased, all four layers conduct until the current drops below the PUT's 'holding current', and high impedance will appear between ANODE and CATHODE again.

Q5 is a PUT with GATE tied to 30V. C15 is charged by a current source formed by CR15, Q8, R23, and R24. When C15 has ramped to about 30.7V, Q5 fires, dumping the charge from C15. The current source is designed to be below the PUT's holding current, so Q5 resets and the cycle is repeated every 3.3 seconds. This is how START-UP OCCURS: when Q5 fires the first time, most of the charge on C15 passes through R26, CR16, and Q6 into C17 and C18, providing power for the primary circuitry. After the initial pulse, Vc.pri is sustained by the output of transformer T1 via CR18. Q6 is configured as a SOURCE FOLLOWER, so Vc.pri is regulated to be 14V nominal (CR14 zener voltage minus Vgs(th) of Q6).



Primary Circuit Power
Figure 2-32.

2-44 FORWARD CONVERTER AND VOLTAGE REGULATION (Figure 2-33).

This is a switching, forward converter battery charger. L5 is the swinging inductor; CR26 contains the forward and catch diodes; C20 is the filter capacitor. The battery is connected in parallel with C20 through a fuse.

The float charge regulator and low battery shutdown circuit are powered when AC is connected or a good battery is installed. The over voltage crowbar is powered only when AC is connected. The AC.ON circuit (R29-31, CR27-28, C19 and Q15) pulls the signal labeled AC.ON to ground whenever AC is present as signified by switching action in T1. When AC.ON is not asserted low, Q14 removes power from the crowbar and allows the crowbar voltage feedback network (R48-49) and the charge voltage feedback network (RT1, R36-38) to float high, thereby extending standby (no AC power) battery life.

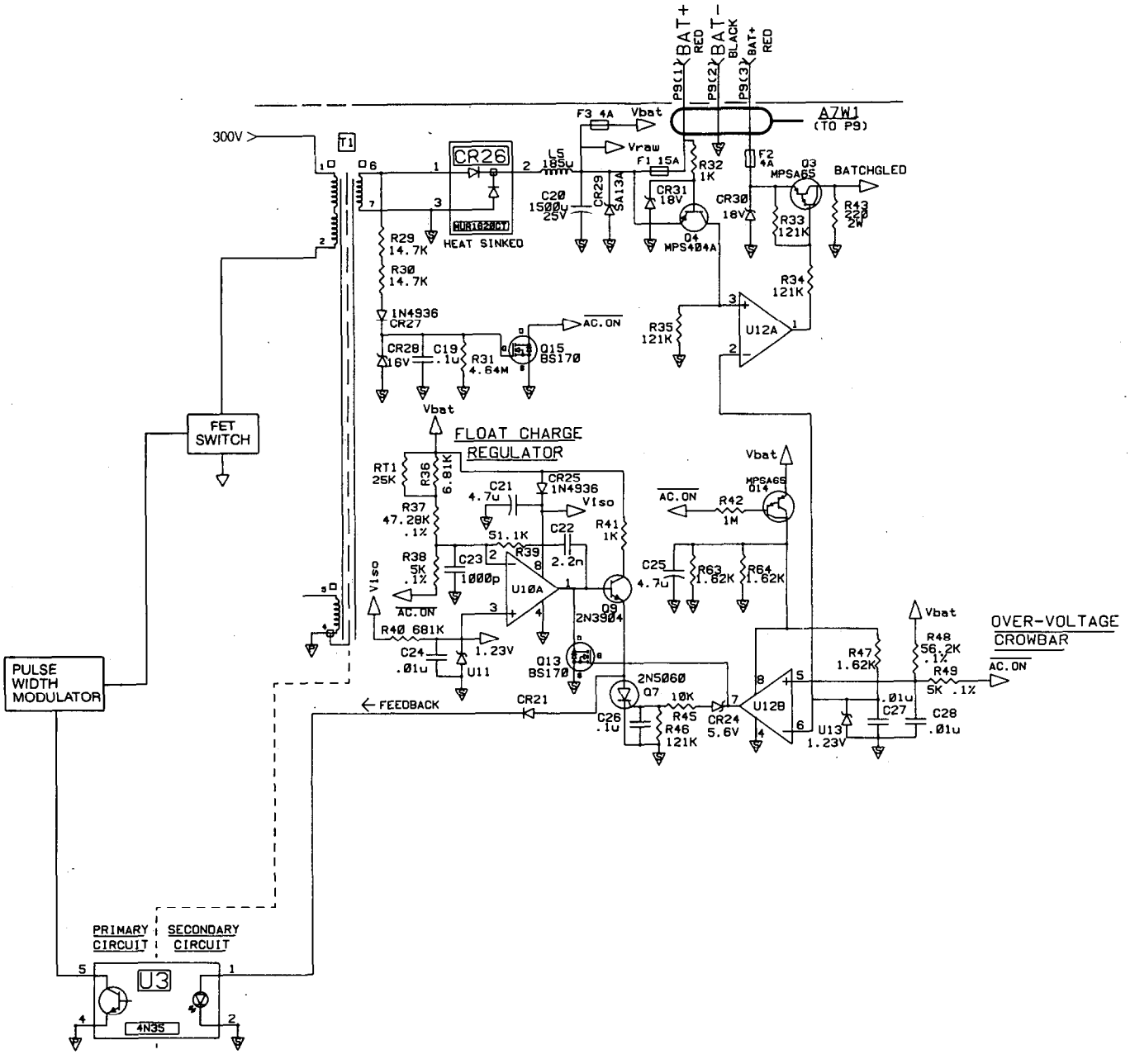
Fuses F1-3 protect the instrument from the large amount of energy contained in the battery in the case of overload faults. F1 is rated 15A and provides the current to Vraw and the high voltage charger board (A5). The battery is charged through F1 when AC is connected. The remainder of the instrument is supplied through F2 and F3, which are rated 4A.

When AC is connected, U12 is powered through Q14. This enables U12A to drive Q3 and turn on the front panel charge LED. If F1 has blown and the battery voltage is high the charge LED would still light even though the battery is not being charged. Q4 detects this situation and will prevent the charge LED from lighting within a short time after this failure mode occurs.

The float charge regulator (U10A) compares the charge voltage feedback with a 1.23V reference (U11) to determine if the output voltage should increase or decrease. U10A controls the current through Q9 which supplies the OPTO-isolator (U3). More current results in a higher output voltage, less current in a lower output voltage. RT1 temperature compensates the charge voltage feedback to provide a more ideal battery charge voltage over the operating temperature range. R39 and C22 compensate the control loop formed by the float charge regulator and the primary side off-line switcher. CR25 and C21 create Viso which powers U10 and U11. This isolates these components from Vbat sag which occurs when in high voltage charge mode and the battery is defective or disconnected.

The overvoltage crowbar shorts the switching supply feedback to force shutdown in a fault situation. U12B compares the crowbar feedback voltage to a 1.23V reference (U13). If too high the SCR (Q7) is triggered. To recover from crowbar mode the feedback current through Q9 must go to zero. To ensure that this can occur Q13 also pulls U10A output low. CR24, C26, R45 and R46 provide noise protection for Q7.

In the case of a primary side regulator fault the secondary side crowbar is not effective. To prevent battery venting due to overvoltage in this situation, CR29 is designed to fail as a short circuit. This will cause immediate opening of F1 which disconnects the battery.



Forward Converter and Voltage Regulation
Figure 2-33.

2-45 LOW BATTERY SHUTDOWN (Figure 2-34)

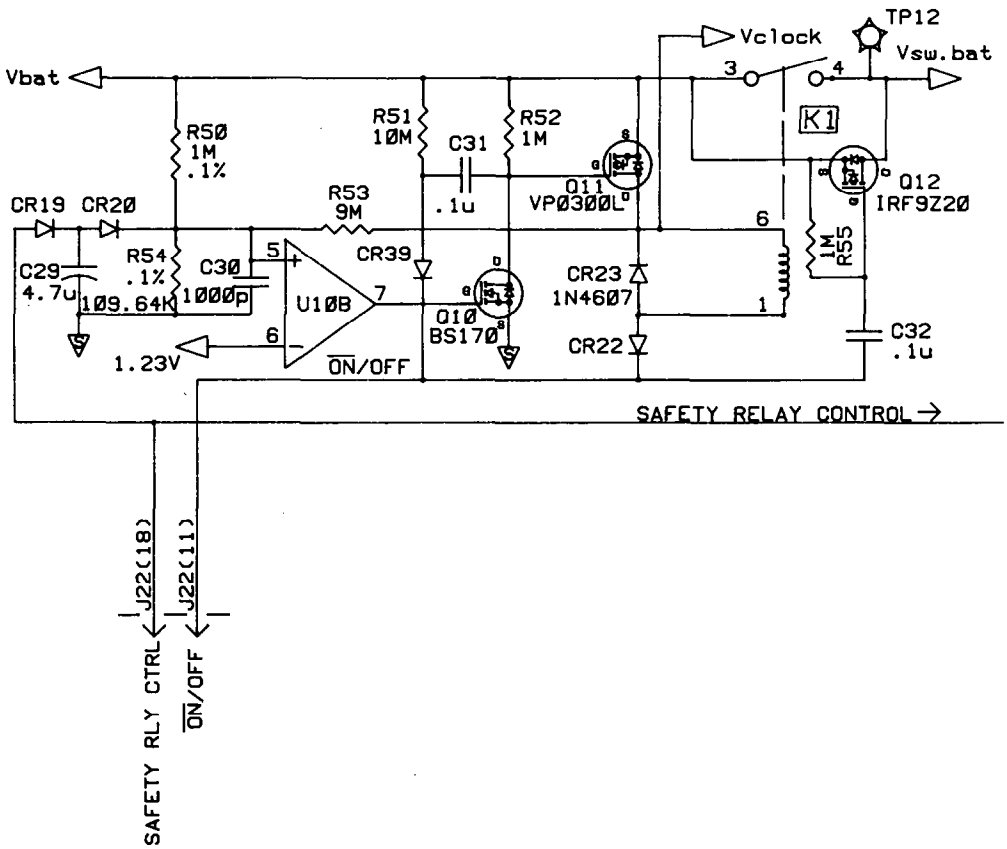
The battery is connected to the Defibrillator Charger Board (J21, pin 1) through a 15A fuse F1. After F1 the battery voltage is labeled Vraw. Vraw is connected to the float charge regulator and the LOW BATTERY SHUT-DOWN circuit through a 4A fuse F3. After F3 the battery voltage is labeled Vbat. Vbat is connected to other parts of the instrument through relay K1, controlled by the LOW BATTERY SHUTDOWN circuit and the front panel ON/OFF switch. To activate K1, the front panel ON/OFF switch must pull J22 pin 11 LOW to ground and U10B output must be HIGH.

U10B is configured as a comparator with hysteresis. R50, 53 and 54 set the ON/OFF voltages (Vbat) at 12.64V/11.37V. The output of U10B controls the relay K1 through two inverting stages Q10 and Q11. After a SHUTDOWN incident, the instrument may be turned ON again briefly by turning the front panel switch OFF and then back ON. When the front panel switch is OFF, J22, pin 11 is disconnected from ground and C31 will discharge through R51 and R52. When turned ON again, the ensuing transient will pull the GATE of Q11 low through C31 and U10B is latched high, even if the 12.64V hysteresis requirement is not met.

When Q11 is ON, power is supplied to the instrument's REAL TIME CLOCK (Vclock). If Q11 is OFF for more than a few minutes, the clock loses its power and must be re-set. (There's a backup cap that sustains the clock for temporary battery disconnections, for example, for battery replacement.) While Q11 is OFF, R53 is not pulled HIGH through R51 due to the blocking action of CR22. Q11 comes back ON when the battery charger is connected to AC line and Vbat comes up again.

Whenever SAFETY RLY CTRL is HIGH (SAFETY RELAY opens), there can be an extra load on the battery due to the defibrillator HV charger, and the battery voltage may be depressed. At these times, through CR19 and CR20, the noninverting input of U10B is held HIGH, preventing SHUTDOWN. After SAFETY RLY CTRL returns LOW again, C29 continues to hold off the SHUT-DOWN function breifly, allowing time for battery chemistry (and voltage) to recover.

Q12 is briefly turned on by C32 and R55 when ON/OFF is pulled LOW. This occurs much more quickly than K1 can close. Q12 passes the transient current which charges capacitors on Vsw.bat thereby relieving K1 from this transient stress.



Low Battery Shutdown
Figure 2-34.

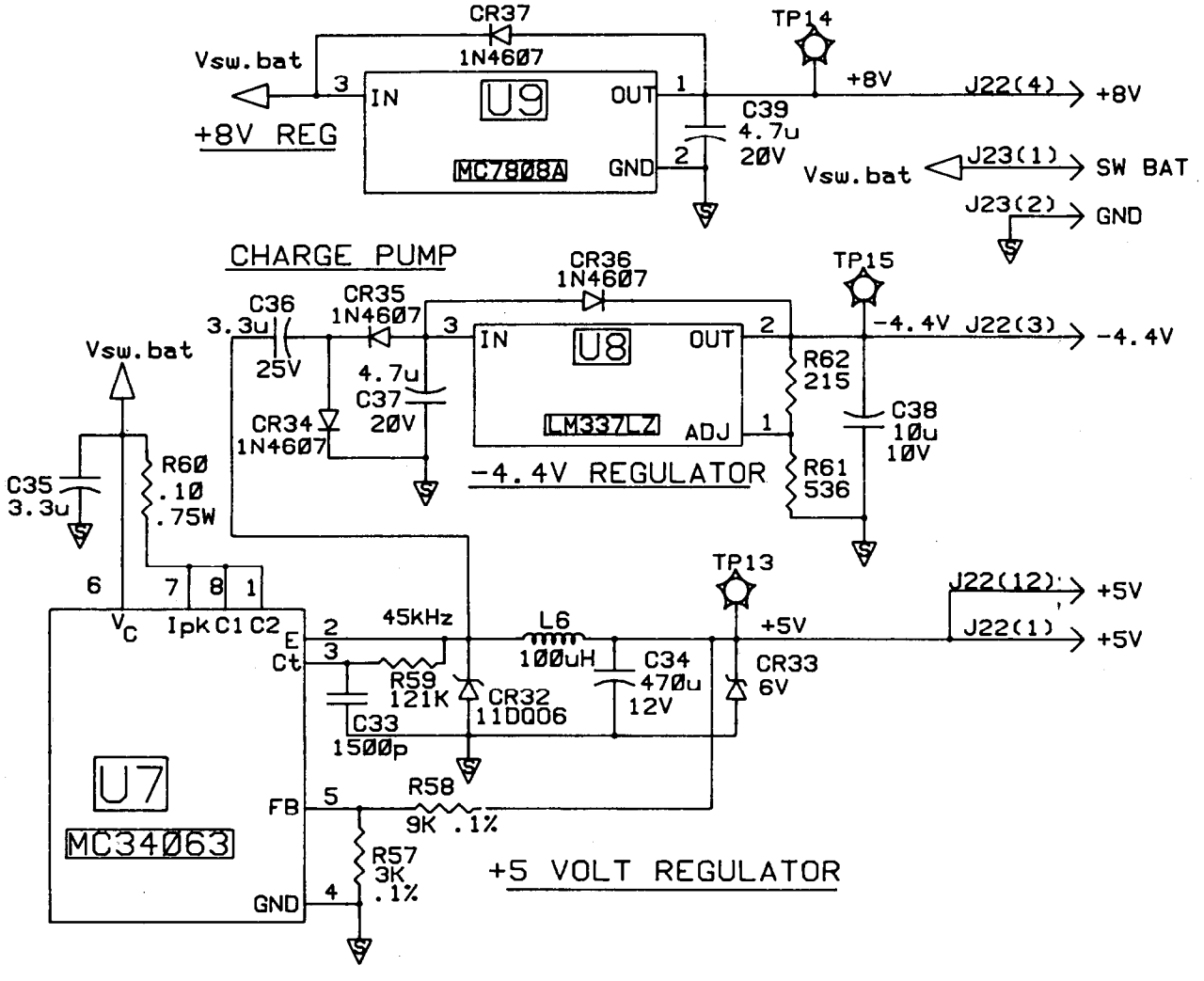
2-46 REGULATED LOW VOLTAGE SUPPLIES (Figure 2-35)

Vbat becomes Vsw.bat after passing through relay K1. The three low voltage supplies are powered by Vsw.bat. U9 is a +8V linear regulator.

U7 is a switching +5V regulator that is similar to the off-line switching power supply discussed in the earlier sections with swinging inductor L6, filter capacitor C34, catch diode CR32, an internal NPN darlington transistor with emmitter connected to pin 2, that is like the forward diode.

The 5V is regulated by comparing a division of R57 and R58 with the internal 1.25V reference. U7 runs at about 45KHz, which is set by C33 and an internal current source. R59 is for loop compensation. R60 is a CVR for setting the current limit.

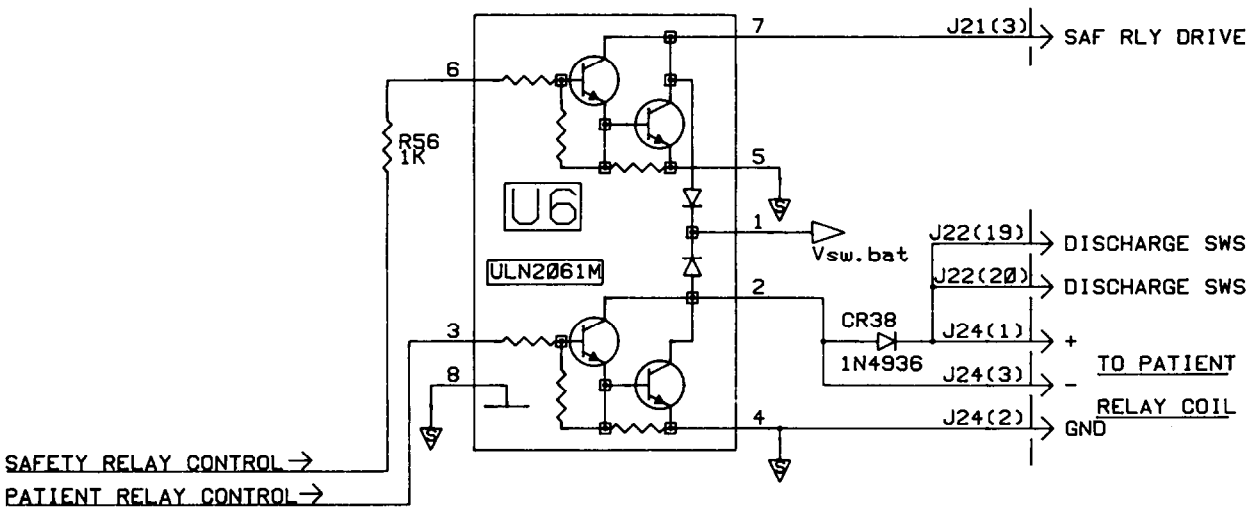
The switching output of U7 also drives a charge pump formed by C36, C37, CR34, and CR35. A negative, linear regulator (U8) runs off the charge pump. R61 and R62 set the output at -4.4V.



Regulated Low Voltage Supplies
Figure 2-35.

2-47 RELAY DRIVERS (Figure 2-36)

U6 is a darlington driver for driving the SAFETY and PATIENT relay coils. Control signals come from the Control Board and the collectors are current sinks for the respective relays which reside elsewhere in the instrument. Internal diodes limit the inductive kick when the transistors turn OFF.



Relay Drivers
Figure 2-36.

A. INSTRUMENT MODES.

3-1. SERVICE MODE:

1. Turn unit off for 5 seconds.
2. Press and hold the SYNC button.
3. Turn the ENERGY SELECT knob on to the MONITOR position.
4. Release the SYNC button after about one second. (The alternately flashing HP/888 will end prematurely.)
5. Battery voltage should be flashing with 3 decimal points.
6. To exit service mode turn unit off, or discharge with the paddles out of the pockets.

3-2. READ BATTERY VOLTAGE:

1. Place the unit into Service Mode.
2. Battery voltage should be flashing on the energy display with 3 decimal points (i.e. 14.2 volts would be indicated by 1.4.2. flashing on the display).

NOTE

Unit plugged in and battery charger working normally ~14.2 V
Unit not plugged in and battery fully charged ~13 V
Low battery warning message comes on ~11.8 V
Low battery shutdown ~11.2 V

B. LEVEL II PERFORMANCE CHECKS

Perform these checks every six months. For best results, use the equipment recommended. Record the defibrillator serial number and the date the checks were performed.

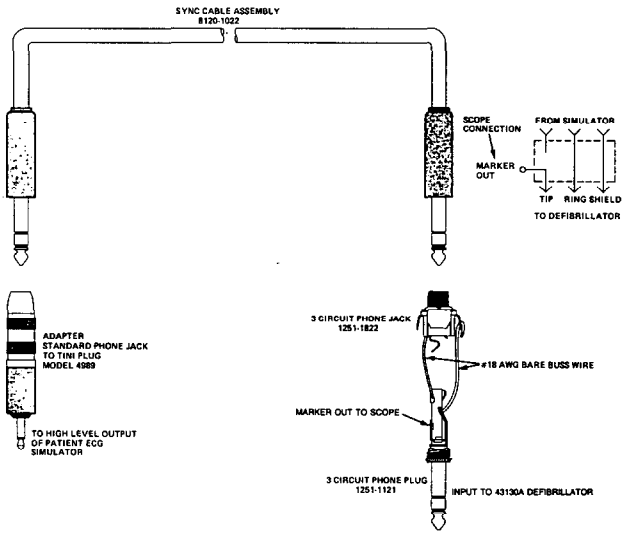
3-3. TEST EQUIPMENT

Test equipment required for performing the level II performance, safety and maintenance checks is listed in Table 3-1.

Test equipment characteristics and a recommmended commmercial model are included. If the recommended model is not available, select another with similar characteristics and capabilities.

WARNING

LETHAL VOLTAGES ARE PRESENT INSIDE THE DEFIBRILLATOR AND ARE EXPOSED WHEN THE DEFIBRILLATOR COVERS ARE REMOVED. DO NOT WORK INSIDE THE INSTRUMENT WHEN POWER IS APPLIED OR IF DEFIBRILLATOR IS CHARGED.



ITEM	MFG. or SUPPLIER	MODEL or PART NO.
Adapter, Std. Phone jack to TINI Plug	Pomona Electronics, Div. I.T.T.	Model 4989
3 circuit Phone Jack	Hewlett-Packard	HP P/N 1251-1822
3 Circuit Phone Plug PJ-05/(W/E 310)	Hewlett-Packard	HP P/N 1251-1121
Sync. Cable Assembly	Hewlett-Packard	P/N 8120-1022

Figure 3-1. Sync Cable Assembly.

Table 3-1. Required Test Equipment for Performance, Safety, and Maintenance Tests.

REQUIRED TEST EQUIPMENT FOR LEVEL II PERFORMANCE, SAFETY, and MAINTENANCE TESTS	
DIGITAL VOLTMETER Recommend: HP 3466A	Capable of 5 to 15 V dc ±1% measurements
OHMMETER Recommend: HP 3466A	Capable of 0.1 to 10 ohm ±2% measurements
ENERGY METER Recommend: Dempsey Model 429	Capable of 5 to 400 Joule, critically damped sinusoidal waveform measurements with ±2% of full scale accuracy. Load resistance 50 ohm ±5%.
STOPWATCH OR TIMER	Capable of measuring 2 to 12 second events with hand start/stop actuation to ¼ sec. accuracy
PATIENT ECG SIMULATOR Recommend: Parke-Davis 3175 Dynatech Nevada 212B	Output Level: High level CAL or ECG .5 to 5 volts outputs
TEST CABLES AND COMPONENTS (1) Marker to discharge delay test setup	See Figure 3-1
SAFETY ANALYZER Recommend: Dempsey Model 431F	

3-4. ENERGY ACCURACY

Connect the Equipment as shown in Figure 3-2.

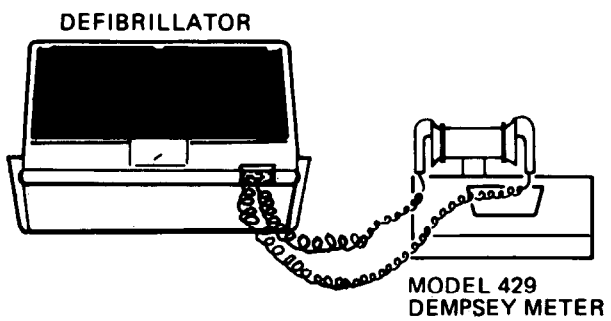


Figure 3-2. Energy Accuracy Test Setup.

With the instrument in service mode (See Section 3-1.), set the ENERGY SELECT knob to each of the positions indicated in the table below; press the CHARGE button and allow the unit to charge. The CHARGE DONE tone will sound and the CHARGE DONE indicator on the Apex paddle and on the display panel will light when the unit is ready to discharge. Firmly press the paddles to the energy meter and press both DISCHARGE buttons simultaneously. Record the energy levels measured.

Compare the delivered energy levels indicated on the Dempsey with the information below.

Table 3-2. Energy Accuracy and Energy Switch Check.

Energy Selected	Delivered Energy (Joules)
2	1 - 3
3	2 - 4
5	4 - 6
7	5 - 9
10	8 - 12
20	16 - 24
30	26 - 34
50	43 - 57
70	60 - 80
100	85 - 115
150	127 - 172
200	170 - 230
300	255 - 345
360	306 - 414

Perform the following test for an early indication of a worn Energy Switch.

1. Exit the service mode by turning the unit "OFF".

2. Rotate the switch from the "ON" position to the "360" Joule position. Repeat two or three times at different rates, from slow to fast. Observe the Delivered Energy Display and LED indicators which should remain stable at all times. If any of these flash, flicher, or display error messages, it is an early indication of a worn Energy Switch.

3. If any of the above symptoms are observed, replace the Energy Switch before returning the unit to service.

3-5. SELF-TESTING ACCURACY

1. Make sure the paddles and the paddle contacts in the storage pockets are clean and free of contaminants. This is to assure good electrical contact and prevent paddle surface damage during discharge.

2. Place the paddles firmly in their storage positions. Apex on the right side and Sternum on the left.

3. Turn the unit on in service mode (See Section 3-1.)

4. Select 100 J with the ENERGY SELECT knob. Charge and discharge the unit.

5. The test energy should flash on the display 3 times (90-110 Joules).

6. Repeat at 360 J for results of 324-396 Joules.

3-6. DEFIBRILLATOR CAPACITOR CHARGE TIME

Place the instrument in the service mode (See Section 3-1.) and unplug the unit from AC power. Read the battery voltage (See Section 3-2.). If the battery is above 12.3 volts proceed, otherwise allow it to charge fully by plugging into an AC outlet for 8 hours or more.

Set the energy to 360 Joules and press the CHARGE button. The CHARGE DONE tone should indicate charge completion in less than ten seconds.

3-7. SYNCHRONIZER

1. Set the ENERGY SELECT switch to 20 Joules, and press the SYNC/DEFIB button to enter the Sunc mode. The SYNC LED should light on the display panel, and blink off each time a high-level ECG is detected or sync pulse received.

2. Place the paddles in their storage pockets.

3. Press CHARGE on the Apex paddle to charge the unit. The charge is done when the CHARGE DONE tone turns on and the CHARGE DONE LEDs on the Apex paddle and the display panel light.

4. Press both DISCHARGE buttons simultaneously. The unit should not discharge.

5. Connect a signal source (for example, the CAL or HIGH-LEVEL output of a Patient ECG Simulator) to the SYNC/ECG input on the 43130A. The signal source should have a .5 to 5 volt amplitude; the wave shape is not critical.

6. Charge the unit to 20 Joules again.

7. Press and hold both DISCHARGE bottons. The unit should discharge in synchronization with the input signal from the Patient ECG simulator.

C. SAFETY AND MAINTENANCE CHECKS

These checks should normally be performed every six months or after a major repair.

NOTE

Make these intital checks before performing the safety tests.

1. Check that the paddle electrodes are in good condition, clean and not pitted. Remember to check pediatric electrodes as well as the adult adapters. Check for obvious cracks (small chips, gouges and scratches are acceptable and will not affect instrument performance). Check cable strain reliefs for cracks or other signs of deterioration at the paddles.

2. Check that the CHARGE button will initiate charge and DISCHARGE buttons function when the cables are stretched to their full length. Check that discharge only occurs when both buttons are simultaneously pressed.

The safety tests listed here are performed at the time of manufacture to assure compliance with IEC, UL and CSA standards. These tests should be part of your preventive maintenance program, and should be performed after any corrective maintenance to the instrument.

a. Chassis-to-ground resistance

b. Ground wire leakage current

c. Enclosure leakage current

d. Patient lead leakage current (source leakage) to ground

e. Patient lead leakage current (sink current) under single fault conditions

To perform these tests, use one of the safety testers or analyzers designed specifically for this purpose. Follow manufacturer's operating instructions for hookup and test procedures. Specific regulatory agency standards that may apply for your particular area are as follows:

a. Underwriters Laboratories Inc.
UL 544 Medical and Dental Equipment

b. Canadian Standards Association
CSA C22.2 No. 125 Electromedical Equipment

c. International Electrotechnical Commission
IEC 601-1 Safety of Medical Electrical Equipment
First Edition

d. International Electrotechnical Commission
IEC 601-1 Medical Electrical Equipment
Second Edition

e. International Electrotechnical Commission
IEC 601-2-4 Cardiac Defibrillators and Cardiac Defibrillator-Monitors

D. ADJUSTMENTS.

Internal adjustments are made at the factory and normally do not require attention. If assemblies are repaired or replaced, however, check and adjust as necessary.

All test equipment necessary to make the adjustments is listed in each Adjustment Procedure.

The instrument case must be opened to gain access to the adjustment controls. Refer to Section IV.

3-8. DEFIBRILLATOR OUTPUT ENERGY CALIBRATION

This is for adjustmenent of the output energy on discharge. Adjustment location is on the Control Board 43130-60200 (A7).

Equipment required:

Energy Meter Recommend: Dempsey 429/428A,B	Capable of 2 to 400 Joule measurement with critically damped sinusoidal waveform. Accuracy ±2% of full scale Load resistance 50 ohms ±5%.

Procedure:

1. Set the Energy switch to 100 Joules.
2. Place the paddles in contact with the energy meter contacts, press the CHARGE button, and after the CHARGE DONE LED on the Apex paddle lights, press both DISCHARGE buttons.
3. Adjust the HV capacitor voltage signal by adjusting R79 if necessary, to obtain proper delivered energy.
4. Set the Energy switch to 360 Joules.
5. Charge and discharge the defibrillator into the energy meter and again make adjustments of R79 until the energy delivered is equal to or slightly greater than the energy switch setting.
6. Check settings to confirm they are meeting specifications below:

Table 3-3. Delivered Energy Specifications

2 J + 1 J	30 J + 15%	300 J + 15%
3 J + 1 J	50 J + 15%	360 J + 15%
5 J + 1 J	70 J + 15%	
7 J + 2 J	100 J + 15%	
10 J + 2 J	150 J + 15%	
20 J + 4 J	200 J + 15%	

7. If an adjustment has been required, the self-test accuracy should be tested and adjusted also (refer to 3-9).

3-9. SELF TEST ENERGY ACCURACY ADJUSTMENT. (A7 R80).

This is for adjustment of the peak current circuit output to calibrate the self test mode accuracy. Adjustment location is on the Control Board 43100-60200 (A7).

NOTE

The Defibrillator Output Energy Calibration must be performed before this adjustment (refer to 3-8).

NOTE

To avoid overheating of the internal 50 ohm test load (with consequent inaccuracies of the derived information) do not exceed the equivalent of three 360 J discharges per minute.

Procedure:

1. Put the instrument in Service mode (see Section 3-1). Place paddles in storage pockets.
2. Set the Energy switch to 360 Joules. Charge and discharge the defibrillator.
3. Adjust the I-peak potentiometer R80 to obtain a self test reading on the display of 360 Joules.
4. Set the Energy switch to 100 Joules. Charge and discharge the defibrillator. Check that the Selftest reading, is between 90 and 110 Joules.

3-10. SWITCH SETTINGS.

Six switches in a DIP package are located on the Control board A7. One of these switches is used to customizet the unit's operation. Under normal operation they should never need changing. Their function is listed here against the case of inadvertant changes or if the control board is changed and needs to be set. When viewed from the front of the instrument the switches are numbered from 6 to 1.

Switch 1—This switch is not used and its position is not critical.

Switch 2—Revert to Defib. Switch 2 changes SYNC operation so that the unit will revert to Defib mode after a synchronized discharge. Left position unit will remain in Sync after discharge, and right position unit reverts to Defib mode.

Switches 3 thru 6—These switches are not used and their positions are not critical. However, they should be kept in the left position.

3-11. CHARGE DONE TONE OPTION.

The CHARGE DONE tone function can be permanently eliminated by removing CR23 on the control board. Refer to Section VI for location of CR23.

WARNING

DISCONNECT THE DEFIBRILLATOR FROM THE A.C. POWER SOURCE BEFORE PROCEEDING.

4-1. BATTERY REMOVAL

1. Refer to Figure 4-1.
2. Rotate the battery cover latches 90 degrees.
3. Open the battery compartment.
4. Unplug the battery connector and remove the battery.

4-2. DISASSEMBLE

1. Remove the Paddles.
2. Place the unit on its top on the workbench.
3. Remove the battery (see Section 4-1.).
4. Loosen screws indicated by the arrows in Figure 4-1.

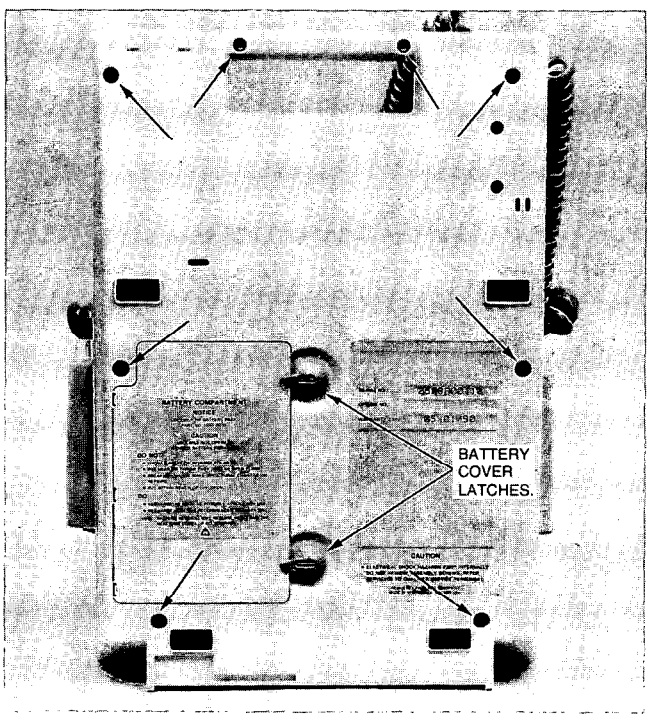


Figure 4-1. Screw Locations for Disassembly.

5. Hold the top and bottom case halves together and turn the unit over. (The screws will fall out.)
6. Lift the top half of the case from the bottom half. Place the top section on its side to the left of the bottom section. See Figure 4-2.
7. For many procedures, the top and bottom sections must be disconnected from each other. If this is necessary, disconnect J22. Refer to Figure 4-3. The green/yellow ground wire must be disconnected from the grounding screw near the energy switch in the top section.

CAUTION

If the battery has been re-installed to operate the defibrillator, remove it before re-assembly. Re-assembly should present no problems. However, some positioning of the ribbon cables will be necessary.

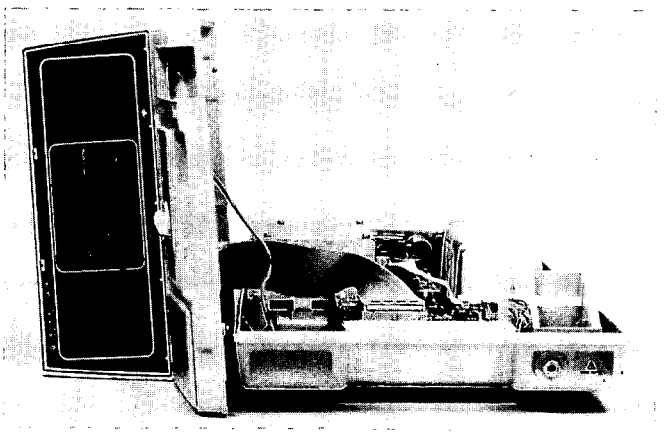


Figure 4-2. Inside View.

4-3. LOW VOLTAGE POWER SUPPLY/BATTERY CHARGER BOARD (A4)

1. Open the instrument as outlined in Section 4-2, Paragraphs 1-5.
2. Remove the battery charger circuit board shield by removing the four screws indicated by the arrows in Figure 4-3.
3. Lift off the cover.
4. Disconnect J9, J21, J22, and J24 (see Figure 4-3.).

5. Unscrew the four aluminum spacers indicated by the arrows in Figure 4-3.

6. Compress the latch on the plastic spacer (Figure 4-4.) and lift the board until it clears the latch. Place a finger under the board at that point and near the circuit breaker connections and lift the board out.

7. When installing this board, be certain the circuit breaker connectors and the plastic spacer engage before pressing the board in place.

8. Reconnect the cables, install the four aluminum spacers and install the shield.

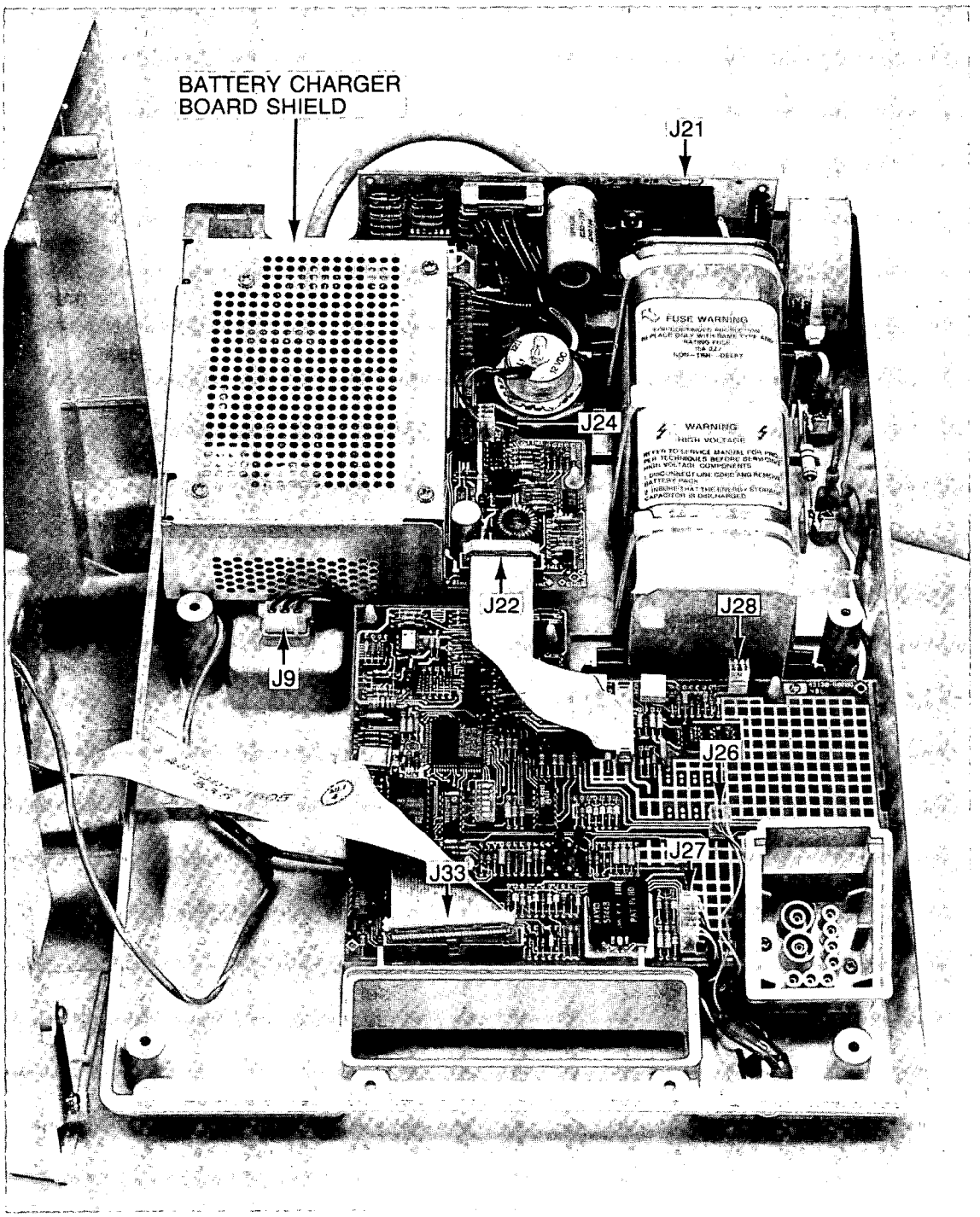


Figure 4-3. Circuit Board Shield Removal.

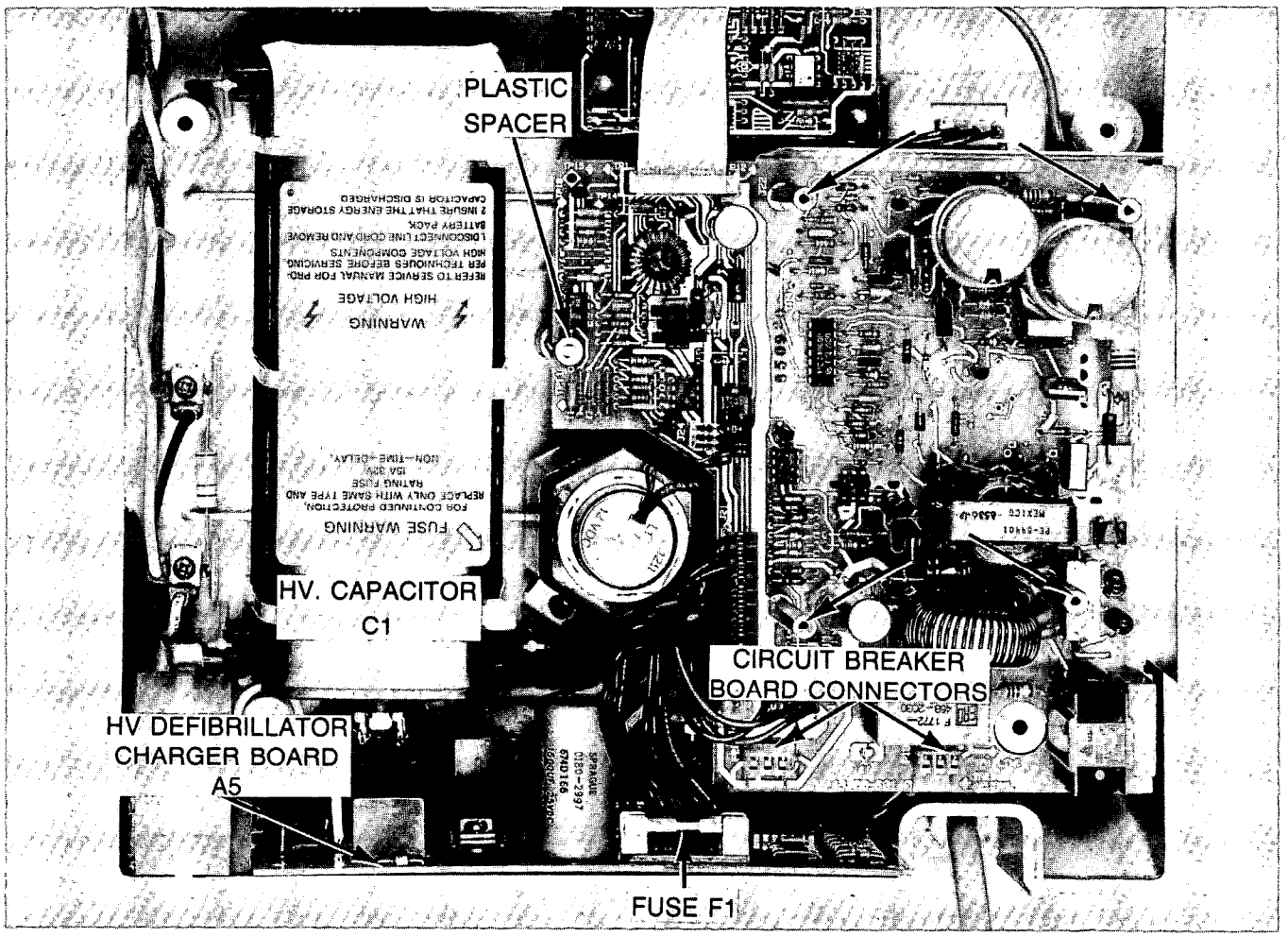


Figure 4-4. Low Voltage Power Supply Board Removal.

4-4. CIRCUIT BREAKER BOARD (A3)

NOTE

A special knurled nut wrench, Part Number 8710-0983, is required to remove the nuts from the circuit breakers. These nuts are made of aluminum and the use of pliers will deface the nuts.

1. The circuit breaker board is located under the L.V. power supply board (A4). This board must be removed to allow access to the circuit breaker board. See Section 4-3. for instructions.

2. The circuit breakers are soldered to the circuit breaker board so the entire assembly must be removed.

3. After the low voltage power supply board is removed, disconnect the A.C. power line quick connect lugs from the circuit breaker board.

4. Remove the knurled circuit breaker nuts.

5. Lift the circuit breaker board assembly out of the case.

6. Refer to Section 4-3 Paragraphs 7 and 8 when re-installing the L.V. power supply board.

WARNING

THE HIGH VOLTAGE ENERGY STORAGE CAPACITOR C1 CAN STORE LETHAL AMOUNTS OF ENERGY. BE CERTAIN THIS CAPACITOR IS DISCHARGED BEFORE TOUCHING ANYTHING RELATED TO THE HIGH VOLTAGE CIRCUIT, I.E. DEFIBRILLATOR H.V. CHARGER BOARD, CAPACITOR C1, PATIENT RELAY K1, H.V. INDUCTOR L1, DISCHARGE ENERGY TRANSFORMER T1 OR PADDLE CABLE CONNECTOR. SHORT CIRCUIT THE H.V. CAPACITOR TERMINALS WITH AN INSULATED HANDLE SCREWDRIVER. WEAR SAFETY GLASSES.

4-5. DEFIBRILLATOR H.V. BOARD (A5)

WARNING

HIGH VOLTAGE. SEE WARNING NOTICE UNDER "HIGH VOLTAGE CIRCUIT COMPONENTS"

1. The defibrillator charger board (A5) is mounted vertically at the rear of the unit behind the H.V. capacitor. See Figure 4-5.

2. Refer to Figure 4-3. Disconnect J21. To remove the board, grasp the upper corners and lift. The board is a rather tight fit and it may be difficult to get it loose.

3. When the board is loose, disconnect two wires from the patient relay and two wires from the H.V. capacitor.

4. When installing the H.V. board, connect the patient relay and H.V. capacitor before pressing board in place.

4-6. PATIENT RELAY (K1)

WARNING

HIGH VOLTAGE. SEE WARNING NOTICE UNDER "HIGH VOLTAGE CIRCUIT COMPONENTS"

1. Remove the L.V. power supply board (A4). See Section 4-3.

2. Remove, but do not disconnect, the defibrillator H.V. charger board (A5). See Figure 4-5.

3. Remove the two screws that secure the patient relay.

4. Lift the relay out of the unit. Disconnect the H.V. wires (two to the H.V. circuit board, two to the H.V. capacitor C1, one to the H.V. inductor L1, and one to a H.V. terminal junction beside the H.V. capacitor.)

5. Reconnect and replace components in the reverse order.

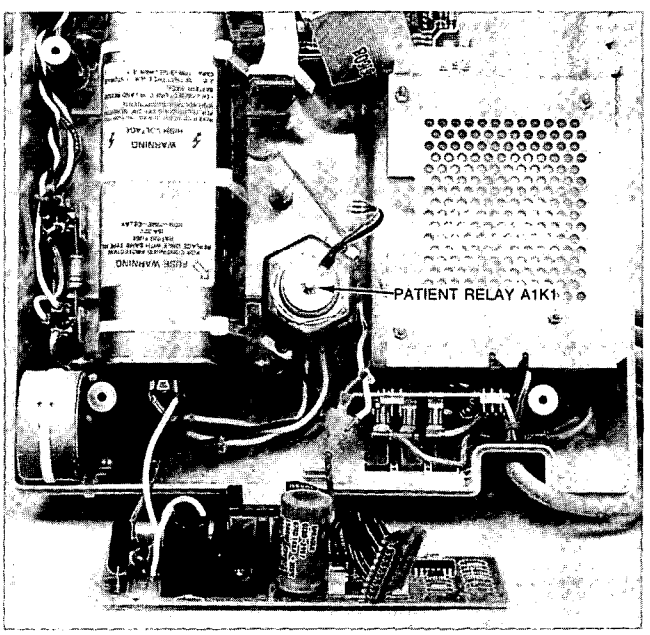


Figure 4-5. Defibrillator Charger Board Removal.

4-7. H.V. CAPACITOR (C1)

WARNING

HIGH VOLTAGE. SEE WARNING NOTICE UNDER "HIGH VOLTAGE CIRCUIT COMPONENTS." BE CERTAIN THE CAPACITOR IS DISCHARGED.

1. Disconnect the four push-on lugs from the capacitor terminals.

2. Clip the three tie-wraps and remove the capacitor.

3. Install the new capacitor and secure with three tie wraps (P/N 1400-1318).

WARNING

DO NOT REMOVE THE RESISTOR FROM THE CAPACITOR TERMINALS.

4-8. SAFETY RELAY

The safety relay is part of the H.V. defibrillator charger board assembly (A5). In case of safety relay failure, the entire assembly should be replaced. See Section 4-5.

4-9. CONTROL BOARD (A7)

1. Refer to Figure 4-3. Disconnect J22, J26, J27, and J28.

2. The control board is located in front of the H.V. capacitor C1. It is mounted in notches in the case behind the handle and on three plastic spacers at the rear of the board.

3. Compress the latches on the plastic spacers, one at a time and lift the board enough to keep the latch compressed. When the last latch is compressed place your fingers under the board near the spacers and lift the board out of the defibrillator.

4. When replacing the board, place the front board edge in the notches in the case. Line up the holes over the plastic spacers and press down evenly so the back of the board remains level as the spacer latches engage.

4-10. DISPLAY OVERLAY PANEL

1. Lift one of the clips at the top of the panel and slip a small flat-blade screwdriver between the clip and the panel. See Figure 4-6.

2. Pry the panel out far enough to allow the clip to drop behind the panel. Now repeat the procedure on the other clip.

3. Lift the panel out. See Figure 4-7.

4. Replacement is a reversal of the procedures outlined above.

NOTE

When re-installing the panel, lift the clips at the top when you press the panel in place.

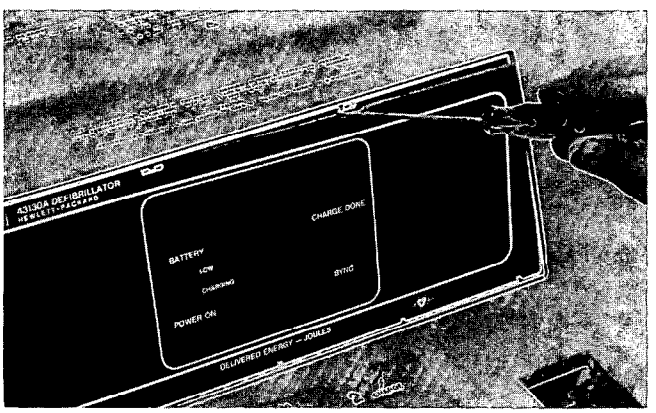


Figure 4-6. Front Panel Removal.

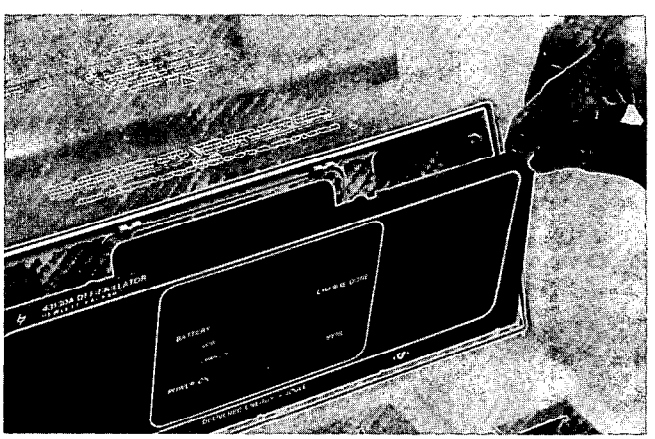


Figure 4-7. Front Panel Removal.

4-11. DISPLAY DIGIT REPLACEMENT

It is not necessary to remove the display board to replace the display digits.

1. Remove the display overlay panel as described in Section 4-11.

2. The digits are socket mounted and can be lifted from the socket. When replacing the display digits, begin on the left end of the socket to be certain of the displays are in the proper socket contacts. See Figure 4-8.

NOTE

Due to variation in display intensity, H-P supplies replacement display digits as a matched set. Order P/N. 43130-69500.

4-12 DISPLAY BOARD REPLACEMENT

1. Open the instrument case as outlined in Section 4-2.

2. Remove the display overlay panel as described in Section 4-11.

3. Remove the 4 nuts indicated by the arrows if Figure 4-9.

4. Lift the display board off the screws and disconnect J40 and J41 on the component side of the board.

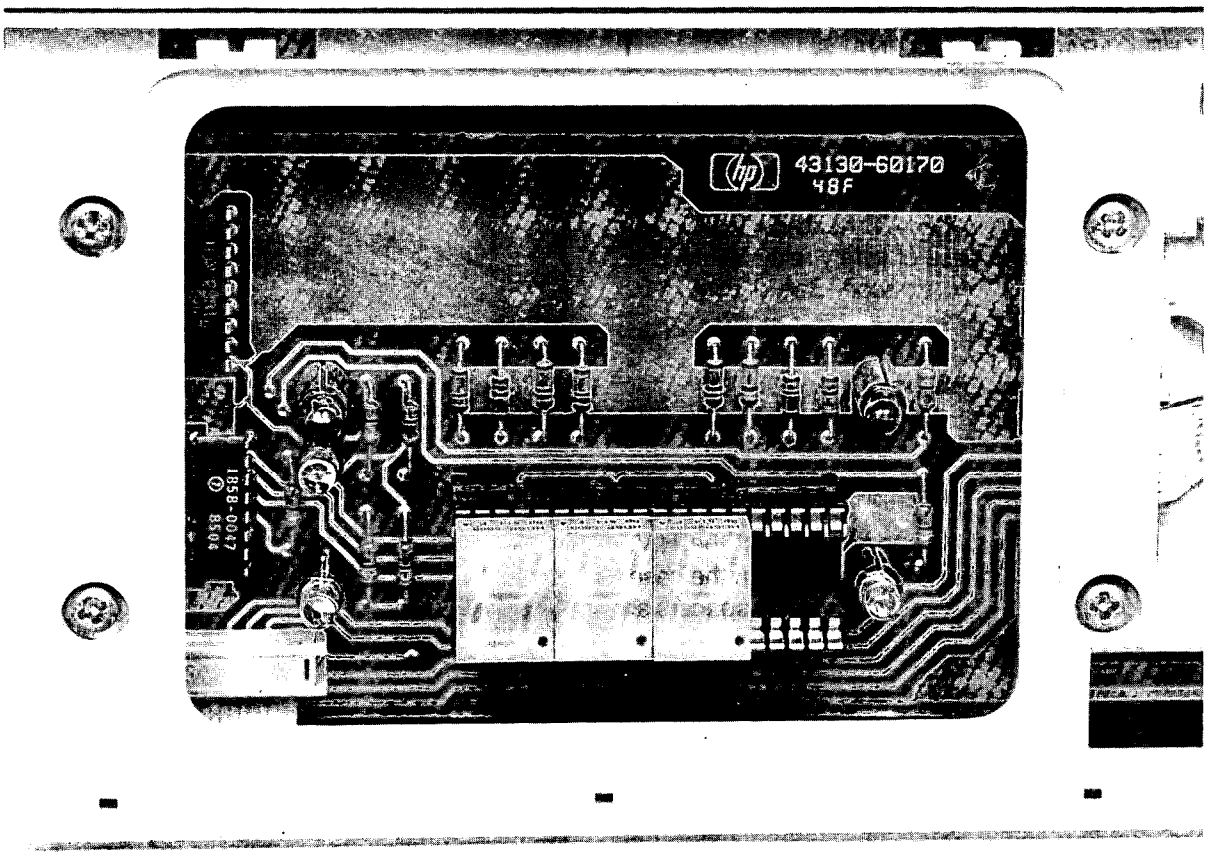


Figure 4-8. Display Digit Replacement.

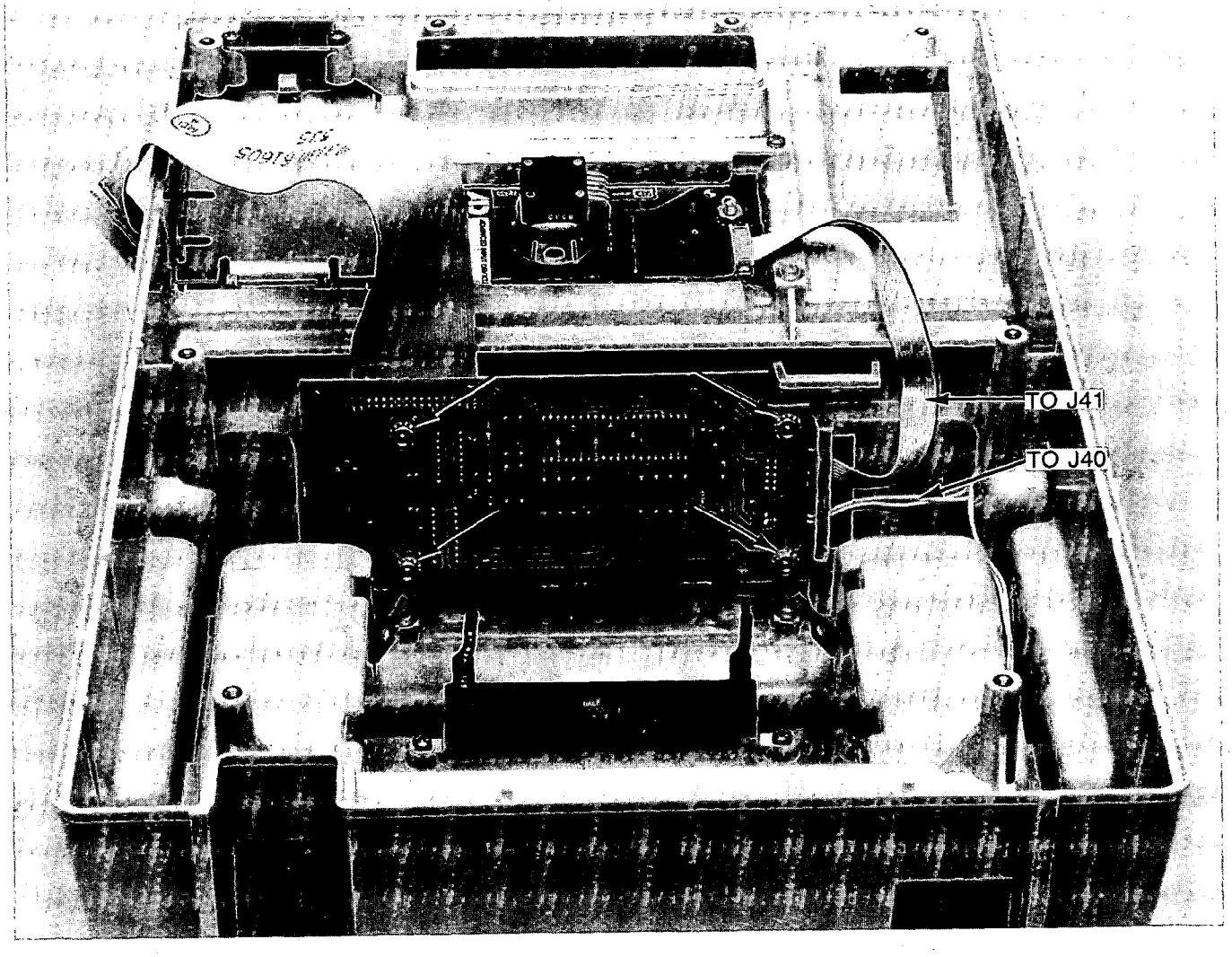


Figure 4-9. Display Board Replacement.

4-13. ENERGY SWITCH KNOB REMOVAL

1. The set screws that secure this knob are only accessible from inside the instrument. Open the instrument as outlined in Section 4-2. For convenience, disconnect the cables so the case halves can be separated.

2. Rotate the energy switch to the OFF position.

3. Insert a 1/16 inch allen wrench through the hole at the top of the switch (inside the instrument) and loosen the set screw. See Figure 4-10.

4. Rotate the energy switch to the 7 Joule position and loosen a second set screw. Both set screws should be loosened about two full turns.

5. It should be possible to remove the knob. If not, loosen the set screws another full turn.

4-14. ENERGY SWITCH (A11-S1) 43100-61901

1. Remove the energy switch knob. See Section 4-14.

2. Disconnect any cables that attach the energy switch board to the rest of the defibrillator.

3. Clip the six switch conductors near the point where they bend. See Figure 4-10.

4. Use a ½ inch nut driver to remove the switch retaining nut. Remove the old switch.

5. Unsolder the switch conductors from the circuit board lugs. Use a solder sucker or solder wick to remove the solder from the circuit board terminals.

6. Install the new switch. Tighten the retaining nut and solder the switch conductors to the circuit board terminals.

7. Be certain the knob is correctly aligned before tightening the set screws. Tighten the screw at the 7 Joule position first.

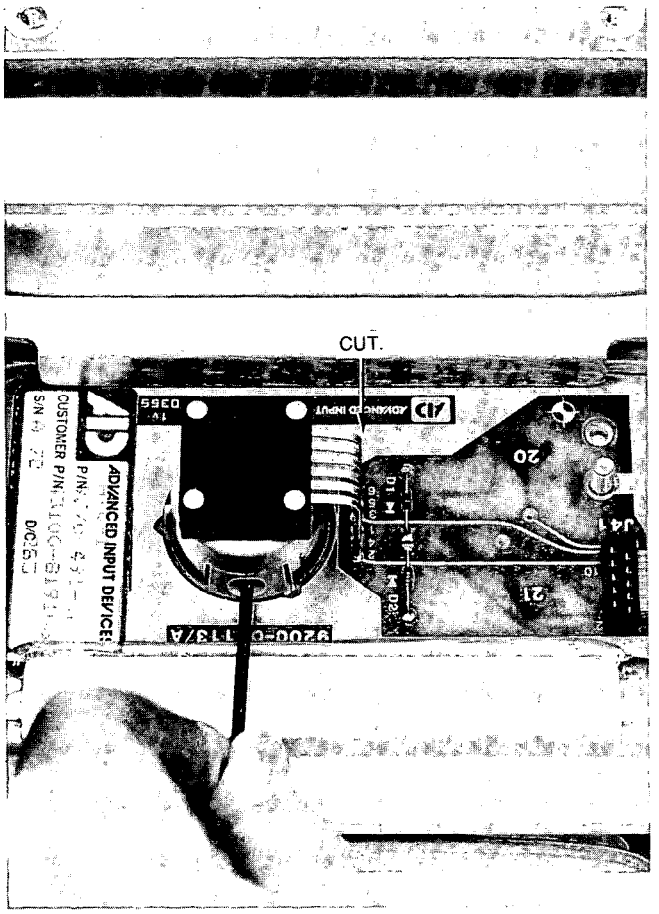


Figure 4-10. ECG Knob Removal.

4-15. ENERGY SWITCH CIRCUIT BOARD ASSEMBLY (A11)

NOTE

The energy switch board is sealed to the upper case half with silicone rubber. This must be removed before the circuit board can be replaced. A model-maker's knife with a small sharp blade may be helpful. There is no known solvent that will dissolve the silicone rubber after it has cured that would not damage the case.

1. Remove the knob. See Section 4-14.

2. Remove the energy switch retaining nut. Remove the two screws that secure the metal bracket at the bottom of the switch board.

3. Disconnect any cables from the energy switch board to other parts of the defibrillator.

4. Use the model-makers knife to cut through the silicone rubber. Remove as much of the silicone rubber from the instrument case as possible.

5. When installing the circuit board use a non-corrosive type silicone rubber. It should not have the acrid smell of acetic acid.

4-16. BATTERY COMPARTMENT LATCHES

1. Remove the battery and battery comparment cover.

2. Open the case as described in Section 4-2.

3. Remove the low voltage power supply board. See Section 4-3.

4. Depending on which latch requires replacement, it may be necessary to remove the patient relay (K1). See Section 4-6.

5. The latch retainer ring may be pried off with a flat blade screwdriver or the ring may be cut with diagonal pliers.

6. Insert the new latch and install new mounting hardware on the shaft. Use long-nose pliers to press the retainer ring into place. Apply pressure on opposite sides of the ring at the same time. Do this at several points around the ring.

4-17. PADDLE SWITCH REPLACEMENT

Paddle switch replacement, anterior-anterior paddles.

Switch replacement consists of replacing a small circuit board assembly. No soldering is necessary.

Paddle	Circuit Board	Label
Apex	43100-60125	43100-84513
Sternum	43100-60135	43100-84514

Tools required: Small posidrive screwdriver, long-nose or flat-nose pliers with very thin jaws.

1. Unplug the paddle set from the defibrillator. If the paddles are not removable, disconnect the defibrillator from AC power line. Make certain the energy switch is in the off position.

2. Remove the label from the top of the paddle handle.

3. Remove the two screws that secure the cover.

4. Slide a knife blade or other very thin object between the rear edge of the cover and cable strain relief. Pry the cover loose.

5. Lift the cover then slide it forward to clear discharge switch button. Set the cover aside.

6. Lift the circuit board out of the paddle. Unplug the connector at the rear of the board.

NOTE

If there is a CHARGE DONE LED mounted on the paddle, unplug the two-pin LED connector on the side of the board opposite the CHARGE switch. See Figure 4-21.

7. Remove the red DISCHARGE switch button and the small spring from the switch actuator. Note that one end of the spring is smaller in diameter.

8. When installing the DISCHARGE switch button, place a finger behind the bend in the actuator so it cannot slide back. The short side of the button goes up.

9. Force the small end of the spring over the rear of the actuator bar. It will be a snug fit. If the paddle has a CHARGE switch, be sure the button is in place before installing the circuit board.

10. Reconnect the wires to the circuit board.

11. Place the board in the grooves in the paddles and press it down. Use long-nose pliers to position the end of the spring over the small projection on the plastic piece behind the spring.

NOTE

If paddle has CHARGE DONE LED route the LED wires away from H.V. lead to paddle.

12. Place the lower front edge of the cover in position at the front of the paddle handle. Rock the cover back so that the discharge button projects through the opening.

13. When everything is in place, install the screws and the label.

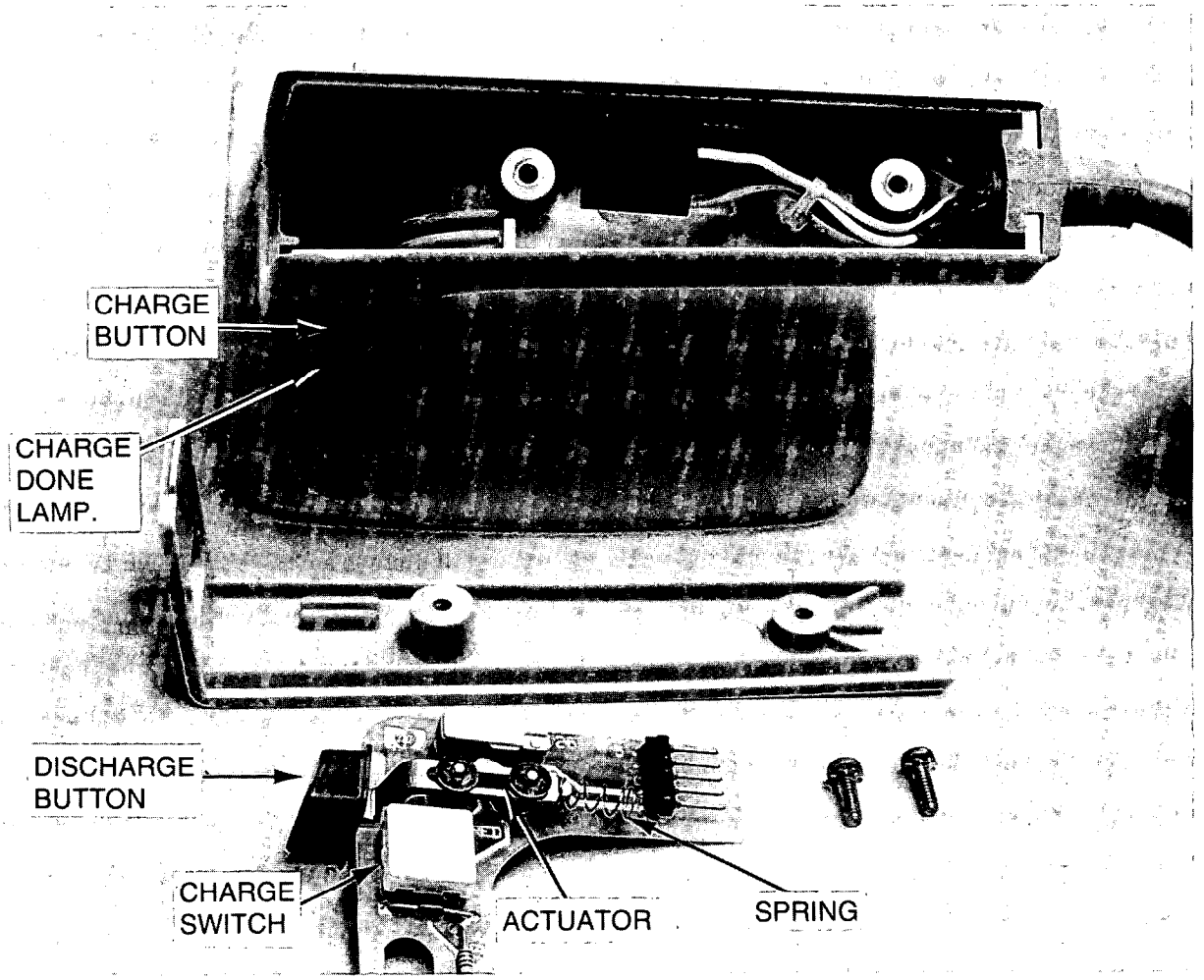


Figure 4-11. Paddle Switch Replacement.

Hint to locating trouble areas:

1. Most problems in troubleshooting this instrument will be logical, i.e., if the display doesn't work the problem is likely on the display board, or the control board.

2. However, in many cases signal lines pass through several boards. For example, the discharge switches pass through the lower case, the control board, and finally the battery charger board to the patient relay.

3. Therefore, although the failure rate is low on the control board, it does have a high opportunity for failure because of its complexity.

4. Remember all functions rely on proper power. Check voltages.

SYMPTOM **PAGE**

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ERROR MESSAGES

SYMPTOM	SUSPECT AREA	CHECKS
Display flashes "E2"	Defib charging too slowly	See Defibrillator secton
Display flashes "E3"	Defib cap arcing	See Defibrillator section
Display flashes "E4"	Defib charged but shouldn't be	See Defibrillator section
Display flashes "E5"	Defib overcharged	See Defibrillator section
Display flashes "E6"	LV supply out of spec	See Battery Charger section
Display flashes "E7"	A/D won't respond	See System Dead section

SYSTEM DEAD

SYMPTOM	SUSPECT AREA	CHECKS
System dead	Power	Check circuit breakers Check battery voltage at the terminals
No low voltage supplies, or switched battery voltage on printed circuit assemblies.	Energy switch panel, A11	Check for continuity between J41 pin 10 and J41 pin 6, when energy switch in 'Monitor On' position.
	Front panel switches, A10	Check for continuity between J33 pin 16 and J33 pin 19 when energy switch in 'Monitor On' position.
	Control board, A7	Check for continuity between J33 pin 16 and J22 pin 11.
	Battery Charger board, A4	See Battery Charger section
Unit does not come on when energy switch is turned on. Audible relay click. Supply voltages okay. No power up tone.	Clock oscillator on Control board, A7	Check U62 pins 6 and 7 for 12 Mhz sine wave, with amplitude of 5 volts. Check U62 pin 8, and U61 pin 18 for 12 Mhz square wave with 5 volt amplitude

SYSTEM DEAD

SYMPTOM	SUSPECT AREA	CHECKS
Same symptoms as above, with or without a continuous power up tone and display	Control processor, U61 or gate array, U62 on Control board, A7	Check Vcc on U62 pins 34 and 68 for voltage > 4.5 volts. Check U61 pin 40 for Vcc of 4.7 to 5.3v. Check U63 pin 20 for Vcc of 4.9 to 5.1 volts. Check pin 1 of U62. This is the decoded "tickle" signal from U61. Signal should be a CMOS logic level signal with a period of 4.167ms (240Hz) and approximate 40% duty cycle. Check U61 pin 9 for a positive going reset signal. Check external address/data bus U61 pins 32 thru 39; U62 pins 9, 11, 12, 13, 15, 16, 19, and 20; and U63 pins 9, 11 thru 17 for activity. Check for pins being stuck high, low, or disconnected. Check WR signal between U61 (pin 16) and U62 (pin 4). Normally should be high with narrow low going strobes. Check ALE signal between U61 (pin 30) and U62 (pin 3). Should be 2 mHz square wave with 300 ns high pulse. Check signal on C6 and U62 pin 2 during turn on. Should take several hundred milliseconds to charge to Vcc.

DEFIBRILLATOR PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Unit will not respond to either charge button or aborts a charge in progress with no error indication.	Paddles have become disconnected from unit	Verify paddles are connected to the unit.
	Cable connections J27 pins 3 and 5	Check for continuity of cable. Also, these two pins should be shorted if external paddles plugged into unit.
	Paddles connector J3 pins 8 and 9	Verify these two pins are shorted together on the external paddles set.
	U61 or U3 on Control board, A7	U61 pins 4 and 5 should be at ground. U3 pins 2 and 12 at ground. U3 pins 1 and 13 at approximately 4 volts.
Unit does not respond to Apex paddle charge switch.	U61 or U3 on Control board, A7	Check signal at J27 pin 4, U61 pin 1, and U3 pins 5 and 6 while pressing and releasing the paddles charge switch.
	R42 on the Control board, A7	Check for connections between Vcc and J27 pin 6.
	External paddles	Check continuity between P3 pins 5 and 6 when paddles charge switch pressed.
Unit does not respond to discharge switches.	U61 or U3 on Control board, A7	Check signals at J27 pin 6, P22 pins 19 and 20, U61 pin 3, and U3 pins 3 and 4; while pressing and releasing discharge switches.
	Paddles	Check continuity between P3 pins 3 and 5 with discharge switches pressed.
50J interlock does not work with internal paddle set.	U61 or U3 on Control board, A7	Check signals J27 pins 3 and 5, U3 pins 1 and 13; all should be at ground. Signals U3 pins 2 and 12, U61 pins 4 and 5 should be high
	Internal paddles	Check for continuity between P3 pins 7 and 8. Check for high impedance between P3 pin 9 and all other pins.

DEFIBRILLATOR PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
The defibrillator does not seem to charge. The CRT displays 0 joules, then in a few seconds displays "E2" and aborts the charge.	A. The defibrillator is charging, but the capacitor voltage is not being recognized.	A. Listen for the high-pitched charging sound when charging is initiated. If it is heard, check TP4 and suspect U2D or a problem on the Vcap line to the A/D on the Control Board. Use caution in the high voltage area!
	B. Cables P21, P11, J10; power supplies; Fuse F1.	B. 1. Check cables for proper connection 2. Check the voltage at P21 pin 7 (SW BAT) with respect to TP1 (GND). It should be greater than 10 volts. 3. Check the voltage at P21 pin 1 (V RAW) with respect to TP6 (GND RAW). It should be greater than 10 volts. 4. Check for fused V RAW voltage (on the right side of the fuse, looking at the component side of the board) with respect to TP6 (GND RAW). If it is less than V RAW, suspect Fuse F1. Remove the fuse and continue troubleshooting to find the cause of the failure.

DEFIBRILLATOR PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
	C. U1 is not receiving the correct input or delivering the correct output.	C. With fuse F1 removed, and during a charging attempt, ensure that: 1. U1 pin 10 is less than 700 millivolts. 2. U1 pin 7 has a sawtooth wave on it. 3. U1 pin 9 is above 1.5 volts. If not, and if CHG RATE CTRL is present, check TP2 and suspect U2C or U2B circuit. 4. U1 pin 1 voltage is less than U1 pin 2 voltage. 5. U1 pin 4 is less than 200 millivolts. 6. U1 pin 3 is not stuck high. If it is, check TP3 and suspect U2A or Q2. 7. TP7 is toggling from about zero to >10 volts.

DEFIBRILLATOR PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
	D. Power MOSFET Q1 Transformer T1.	D. or With Fuse F1 removed, ensure that: 1. The resistance from TP9 to TP7 is >1megohm with TP9 the positive ohmmeter lead. 2. The resistance from TP7 to TP8 is >400ohms with TP7 the positive ohmmeter lead. 3. The resistance from TP9 to TP8 is >1megohm with TP9 the positive ohmmeter lead. 4. The resistance from TP8 to TP9 is like a diode with TP8 the positive ohmmeter lead. Then with Fuse F1 in place, but when not attempting to charge, 1. Accurately measure the voltage from TP8 to TP6. If greater than 1 mV, suspect Q1. 2. Measure the voltage at TP9. If less than V RAW, suspect T1 (primary). Then with Fuse F1 in place, and during a charging attempt, verify that TP7 is toggling from about zero to greater than 10 volts. 1. If TP9 is not toggling, suspect Q1. 2. If TP9 is toggling, suspect T1 (secondary).

DEFIBRILLATOR PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Slow charging (greater than 10 seconds to 360 joules with fully charged battery) or charge aborted with "E2" flashing on the display.	A. J10 is disconnected.	A. Check J10 connection.
	B. Safety relay not opening.	B. With the instrument turned on and all cables connected, verify that neither "E4", "E5" or "E7"are not displayed on the front panel. Measure the voltage at TP4 and verify that it is less than 50 mV. Turn the instrument off and short the 2 terminals of the Main Storage Capacitor with an insulated-handle screwdriver; then connect an ohmmeter from C11 to R19 (neither connection at the junction of C11 and R19). Also connect a jumper from TP10 (CR1 anode) to TP1 (CR4 anode). Turn the instrument on. If the resistance indicates a short, suspect K1.
	C. CR9 or CR10 bad.	C. Disconnect P21, and measure the resistance across CR9. If a short is indicated, replace both CR9 and CR10.
	D. Charge rate control circuit problem.	D. During an attempt to charge, measure the voltage at TP2. If it is less than 1.5V, suspect U2C.

DEFIBRILLATOR PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Charging begins, but then is aborted with "E3" flashing on the display.	A. Main Storage Capacitor arc	A. With the instrument turned on and all cables connected, verify that neither "E 4", "E6,", or "E7" are not displayed on the CRT. Measure the voltage at TP4 with respect to TP1 and verify that it is less than 50 mV. Turn the instrument off and short the 2 terminals of the Main Storage Capacitor with an insulated-handle screwdriver; then connect an ohmmeter across the 2 terminals. If the resistance settles to less than 30K ohms, suspect the capacitor. Remove the ohmmeter.
	B. Capacitor voltage measurement problem.	B. If it is verified that the capacitor is not shorted (see section A directly above), turn the instrument on and observe the voltage at U2 pin 12 during charge. After 800 mV is reached, if there is >10% change in voltage within 10 ms, suspect transformer T1. Otherwise measure the voltage at TP4. After 800 mV is reached, if there is >10% change in voltage within 10 ms, suspect U2D.

DEFIBRILLATOR PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
"E4" flashing on the display.	A. Capacitor voltage measurement problem.	A. Measure the voltage at U2 pin 12. If it is greater than 50 mV, go to section B directly below. Otherwise measure the voltage at TP4. If it is <50 mV, suspect U2.
	B. Safety circuit problem.	B. After performing step A directly above, turn the instrument off to ensure that there is no safety relay drive. Wait at least 20 seconds. Then turn the instrument on. If the "E4" indication does not reappear on the CRT within 10 seconds, perform the following steps: 1. Check the voltage at TP4 to verify that it is less than 50 mV; 2. Short the Main Storage Capacitor with an insulated-handle screwdriver; 3. Remove Fuse F1 for further troubleshooting; 4. Suspect the safety relay drive signal at TP10 and on the Battery Charger Board.

DEFIBRILLATOR PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
I peak error	A7 U2, U1, and associated components	U2B, U1B, and other components form a peak hold circuit. Current that flows through the paddles during discharge is monitored by this circuit. U1B is an open collector output comparator and hence is only capable of ramping the output of U2B in a positive direction. R25 discharges the peak hold circuit whenever IPKRST U62-54 is held high IPKRST is held high except for an 80 msec period during discharge. U2-7 should normally be at zero volts. R23 performs the current to voltage conversion. Suspect U2 if pin 7 has a triangular ripple component during reset.

DISPLAY PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Bat Chg LED not working	Bat chgr off	Verify instrument plugged in, AC power switch on (if applicable).
	Signal path	Follow Bat Chg signal from Bat Chg board to Control board to Display board.
Power On LED not	A8 DS2	Check for voltage across A8 R9 & 10
Displays bright; frequent burnout	8.4V too high	Check for 8.0V-8.8V from A7.
A8 DS, 4, 5, 6, 7, and 8 not lighting or dim	8.4V too low	Check for 8.0V-8.8V from A7.
	A8 U2	Check for voltages across R13 while in SYNC.
A8 DS6, 7, or 8 not lighting correctly	A8 DS6, 7, 8 or A8 U2	Check for drive signals to U2, and voltage across R13, 14, or 15.
	A8 U2	Check for voltages acress R13 while in SYNC.
A8 DS6, 7, or 8 not lighting correctly	A8 DS6, 7, 8 or A8 U2	Check for drive signals to U2, and voltage across R13, 14, or 15.
One digit not lighting correctly	A8 DS3, 4, 5 or A8 U2	Check for drive signals to U2. Interchange DS3, 4, 5 to determine if U2 or digit is bad.
One segment on one LED not lighting correctly	A8 DS3, 4, or 5	Interchange DS3, 4, 5 to verify bad digit
Same segment on all LED's not lighting correctly	A8 U1	Check for drive signals to U1. check for voltage across R1 thru R8.

ECG SYNC OR MARKER PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Synchronizer not detecting QRS complex, i.e., no marker pulse, Sync LED does not flash, and no beep.	ECG output jack of monitor in use.	Check ECG output jack of monitor for high level ECG $\geq$ +.7v or sync pulse > +2v
	Sync Cable.	Check that proper Sync cable is being used to interface the 43130 and the monitor. Check that cable is not shorted or open.
	ECG/Sync input buffer, U65B on Control board (A7)	Check J26 pin 3 for ECG/Sync pulse from monitor. Check U65B pin 7 and U63 pin 5 for inverted signal from monitor. (See section containing waveforms)
Synchronizer detecting QRS complex. Sync LED flashes, beeper sounds on each complex, but no marker pulse.	Marker pulse circuit on control board (A7)	Check J26 pin 1 for marker pulse (approximately -12v and 12 ms). Check U61 pin 10, and base of Q8 for drive signal (+5v and 12 ms). Check collector of Q8 being pulled to ground, from +12v, with each drive signal. Check Q9 collector and emitter being pulled to −12v with each drive signal.
Synchronizer detecting QRS complex. Sync LED flashes, marker pulse working, but no beeper.	Speaker circuit on Control board (A7)	Check U62 pin 10 for 1736 Hz square wave with each QRS complex. Check CR22, R61, Q7, DS1 and R62
Synchronizer detecting QRS complex. Marker pulse working, beeper sounds on each complex. Sync LED not working.	LED circuitry on Display board (A8).	Check U2 pins 6 and 11, R14 and DS6.
	Drive circuitry on Control board (A7).	Check U61 pin 26, R100C, and J33 pin 26.

SERVICE MODE PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Will not enter Service mode.	Control board (A7)	
	SYNC switch (Matrix Column O and Row Z)	Check for switch continuity on Front Panel (A10) and Energy Switch Panel (A11)
Battery voltage is not flashing on display, but display appears to function properly	Main processor U61 on Control board (A7)	
No display	Display board (a)	See Display Problems

SERVICE MODE PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS

WARNING: HIGH CURRENT A.C. LINE VOLTAGE AND UP TO 300 V.D.C. ARE EXPOSED WHEN THE BATTERY CHARGER IS CONNECTED TO A.C. POWER, WITH POTENTIAL LETHAL SHOCK HAZARD! FOR EXAMPLE, THE PRIMARY (A.C.CIRCUITS) GROUND IS SUCH A SHOCK HAZARD WITH RESPECT TO SAFETY/SECONDARY CIRCUITS GROUND.

SEVERAL OF THE COMPONENTS, ESPECIALLY THE HEAT SINKS AND POWER RESISTORS, MAY BE HOT ENOUGH TO CAUSE BURNS IF TOUCHED, EVEN FOR A WHILE AFTER POWER IS OFF!

CAUTION: SINCE THE PRIMARY (A.C.CIRCUITS) GROUND IS AT HIGH VOLTAGE AND CURRENT WITH RESPECT TO GROUND, IT MUST NEVER BE CONNECTED TO ANY INSTRUMENT OR A.C. SAFETY GROUND WHEN CONNECTED TO A.C. POWER! IF GROUNDED, SUCH A CONNECTION WILL CAUSE SERIOUS DAMAGE TO THE BATTERY CHARGER CIRCUITS OR IF NOT, YOU MAY EXPOSE INSTRUMENT FRAMES TO LETHAL VOLTAGES. ANY CONTACT BETWEEN PRIMARY (A.C.CIRCUITS) AND SECONDARY (BATTERY/ POWER SUPPLIES) GROUNDS WILL CAUSE SERIOUS DAMAGE TO COMPONENTS AND/OR CIRCUIT BOARD TRACES!

WHEN MAKING ACTIVATED PRIMARY CIRCUIT MEASUREMENTS OTHER THAN WITH RESPECT TO SAFETY GROUND EITHER USE A DIGITAL MULTIMETER WITH FULL FLOATING, 1000 VOLT RATED INPUT, OR A DUAL PROBE OSCILLOSCOPE OPERATED IN A DIFFERENTIAL INPUT MODE!

ANY CONNECTION WHICH CAUSES POWER FET Q1 TO CONDUCT WITHOUT OPERATION OF U1 DUTY CYCLE OR CURRENT LIMIT PROTECT CIRCUITRY WILL CAUSE Q1 TO SHORT, POSSIBLY DAMAGING R2, Q2, CR8, CR50 AND PERHAPS OTHER COMPONENTS.

CAUTION: DISCONNECT THE BATTERY CONNECTOR BEFORE INSTALLING OR REMOVING THE BATTERY CHARGER BOARD (43100-6014X) TO AVOID TRACE OR COMPONENT DAMAGE.

SERVICE TIPS: MANY COMPONENT CHECKS CAN BE PERFORMED WITH A DIGITAL MULTIMETER WITH A.C. POWER AND BATTERY UNPLUGGED. OBSERVING THESE PRECAUTIONS ARE NECESSARY TO OBTAIN VALID READINGS AND THEY WILL MINIMIZE THE POSSIBILITY OF ELECTRIC SHOCK OR DAMAGE TO BOARD CIRCUITRY.

MOST DIODES WILL TEST A NOMINAL 0.6 V ON A DMM 2K OHMS SCALE, WHICH INJECTS 1 mA. SCHOTTKY DIODES WILL BE NOTICEABLY LOWER. PN JUNCTIONS IN BIPOLAR TRANSISTORS SUCH AS Q2 CAN BE TESTED IN THE SAME WAY. CHECK HIGH CAPACITY ELECTROLYTICS FOR CHARGE ACCEPT ON HIGH OHMS SCALE, OBSERVING CHARGE TIME SIMILARITY.

BATTERY/BATTERY CHARGER PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Battery charging LED is off, battery runs down, unit operating.	A.C. power source	Check A.C. outlet voltage; is plug fully inserted?
	A.C. power switch (220V option only)	Check switch on back of the defibrillator: "0" not shown, green light illuminated?
	Circuit breakers CB2, CB3	Reset breaker(s) & check (some shorts may blow the breaker heater open circuit, see A.C. ON check below)
Battery charging LED is off, unit will not operate.	Battery	Remove battery cover, check for tight connector fit. If problem persists, take out battery, use DMM to check both red wire volts to black wire; if either reads zero or intermittant, replace battery & recheck.
	AT THIS POINT, FURTHER CHECKS REQUIRE DISCONNECTING A.C. POWER, OPENING DEFIBRILLATOR CASE, UNPLUGGING BATTERY CONNECTOR AND REMOVING TOP EMI SHIELD FROM BATTERY CHARGER PCB.	
Battery charging LED is off, system O.K., battery charges.	Charge LED circuit	Check continuity of circuit from Q3 collector through to LED on front panel.

BATTERY/BATTERY CHARGER PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Battery charging LED is off, battery runs down.	Fuseable R2	If open circuit, also use DMM of 2K scale to check CR1, CR4, 5 & 6, Replace if short or open circuited. Check across CR8, replace CR8, CR50,Q1, and Q2 if shorted. also test R9, CR3, replace if short or open. Replace R2, connect battery & A.C. power, checking charge LED & battery voltage (14.2V if battery is charged, lower if battery charge state is lower, but higher than if AC power is disconnected). Is the battery charger LED on now?
	Secondary circuits	Check CR26, CR28, CR29, CR30, CR56, CR57, Q3, Q7, and U3. With DMM.
THE FOLLOWING TESTS REQUIRE CONNECTING THE BATTERY: THIS CAN DESTROY COMPONENTS AND BOARD TRACES IF SHORTED!		
Battery charging LED flashes every 1-3 sec.	U4	If VBAT > 14.5 V during the flash with AC connected, replace U4.
Unit does not work when switched on with battery charged.	U5 circuit	Check for > 12VDC at TP 11 from the battery through breaker CB1. U5: Pin 6 goes from >10 to 0 VDC & pin 1 from >10 to 2.5 VDC; switch off to on, of defective U5 or related circuit component. Q4: Collector from 0 to >10 VDC or replace Q4 or CR35. K1: Replace if coil does not close contacts.

BATTERY/BATTERY CHARGER PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Unit does not work or very abnormal, battery charged	Regulated voltage +5V low if < +4.7 VDC.	If requlated −4.4 VDC O.K., +5 VDC <4.7 VDC, unplug J22, jumper U5, pin 6, to SEC. GND & check +5V. If O.K., reconnect J22, unplug each printer circuit board to locate shorting load (gate array, capacitor, diode) If +5V low with unplugged J22 & jumper (Note: −4.4V will be very low without load on +5V) Check U7 circuit, including CR37-40, CR43, C31, C33, C34, or L6. Note the no load (J22 OFF) & monitor load waveforms in Figs. 3A & 3B. If signs of overheating in U7, etc., check voltages carefully with reconnected load after repair for possible cause on other printed circuit board!
	Regulated −4.4V abnormal	Check with monitor on or 10 ohm, 5 watt load on +5V. If U8, pin 3 is > −7 VDC check C33-35, CR38-40. If U8, pin 3 is −7 VDC and U8 output is abnormal, either U8 is bad or abnormal load conditions will be found on another board.
	Regulated +8V abnormal	Check U9, CR44, C37 or find problem on another board.
Unit does not turn off when battery is below 11 VDC.	U5/Q4/K1 circuit	Run above checks, replacing U5 if bad Q4 if shorted, or K1 if stuck. Also replace battery if it was discharged below 11 VDC: Low capacity!

BATTERY/BATTERY CHARGER PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
Patient or safety relay not operating.	U6 circuit	Check drives to pin 6 or pin 3: If absent, trace back to point of origin. Safety relay: If pin 7 does not go low, pin 6 high, replace U6. Otherwise, trace to relay. Patient relay: Check for >10 VDC at J24, pin 1, when both paddle discharge switches closed - possible paddle circuit problem Check U6, pin 2 low, pin 3 high momentarily, or replace U6. Otherwise check CR36 or trace to relay.
Shutdown occurs with discharge, but battery capacity appears good.	Circuit breakers 43100-6016X	Verify 3 amp breaker installed, not 1.5 amp. Check that resistance is approximately 0.5 OHM between pins 2 and 3 on 6014X P20. Reset breaker or replace 6016X assembly.

BATTERY/BATTERY CHARGER PROBLEMS

SYMPTOM	SUSPECT AREA	CHECKS
	THE FOLLOWING TESTS REQUIRE PRIMARY CIRCUIT TESTS WITH A.C. POWER ON AND BATTERY: OBSERVE CAUTIONS NOTED PREVIOUSLY!	
Still no charging LED and no increase in battery voltage	A.C. rectifier/filter	Use DMM, check for 300 VDC nom. at TP5 with respect to primary ground at TP3: If much less, trace A.C. volts through circuit breaker to P19 through L1, R2, CR1. If fault is located, unplug A.C. and recheck fault area with ohmmeter, and replace component or repair circuit board trace as required. Replace repaired board & test again with A.C. power.
300 VDC at TP5 O.K. but no charge.	Start circuit Q5, Q6	Is C41 charging up to 30V (it takes 5 seconds or so) and discharging through Q5, check CR8, CR54, CR55, and Q6.
	OBSERVE CAUTIONS NOTED ABOVE, USE TWO OSCILLOSCOPE PROBES IN DIFFERENTIAL MODE FOR THE START MODE TEST WHICH FOLLOW:	
	Q3 circuit	Normal charging, voltage on CR24 is >12 VDC.
	U4 circuit	Normal charging, U4, pin 8, is 2.5 VDC, pin 1 is between 3 and 4 VDC.
	U3 circuit	Normal charging, 1.0 VDC, pin 1 to pin 2; 3 to 4 VDC, pin 5 to pin 4.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

This section of the service manual includes schematic diagrams and identifies major assemblies, subassemblies, and components of both defibrillators to aid in ordering replacement parts. Each entry in these tables includes the reference designation, HP part number, check digit, quantity used within the referenced assembly, a brief description of the part, the NEC code of the manufacturer of the part and the part number assigned by the manufacturer. Wherever possible, parts lists for the assemblies are printed on the same page as the schematic diagram and component location drawing or on immediate adjacent pages.

6-2. REFERENCE DESIGNATIONS.

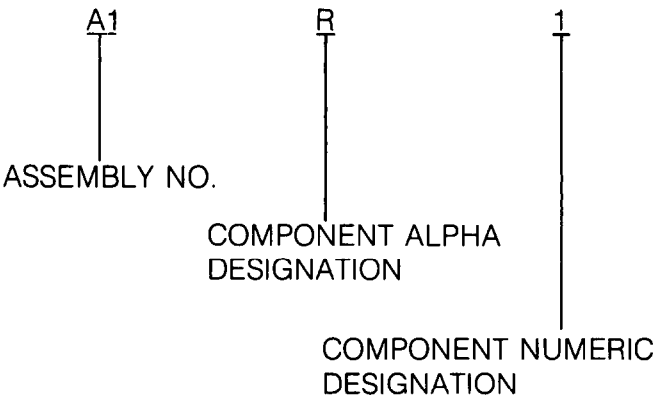
The parts listings use an alphabetical-numerical (alpha-numeric) method of listing the end item, assemblies, subassemblies and circuit components. These items are defined as follows:

1. An END ITEM is the instrument with all the supplied accessories. The END ITEM is made up of assemblies to aid in the location of parts.

2. Each assembly and subassembly is assigned an "A" number (A1, A2, A3, etc). Assemblies and subassemblies that can be purchased have part numbers in the part number column of the table; those that cannot be purchased do not have part numbers in the columns.

3. Components within the assembly and subassembly circuits are assignedf circuit reference designators (C1 capacitor, R1 resistor, etc). These parts are prefaced by the assembly number (A1C1, A2C2, A1R1, A2R2, etc), to indicate the assembly on which the part is located.

An example of the alpha-numeric numbering method used to identify assemblies, subassemblies and circuit components is shown below:



The complete reference designations is read as the first resistor (R1) of the first assembly (A1).

6-3. ORDERING INFORMATION.

NOTE: Occasionally, electronic items in the replacement parts list will be found to carry standard commercial identification numbers but which also are indicated as being manufactured by HP. These components have been selected to meet specific operational criteria. The use of these components purchased through normal commercial channels may result in degradation of the operation performance or reliability of the unit.

To order a replacement part, address order or inquiry to the local Hewlett-Packard Sales/Service Office (see list of addresses at the rear of this manual) and supply the HP part number of the item from the listing.

To order a part not listed in a table, provide the following information:

1. Model number of the instrument.

2. Complete serial number of the instrument.

3. Description of the part including function and location.

To order a part from a manufacturer other than Hewlett-Packard Company, provide the complete part description and the manufacturer's part number from the listing. Manufacturer's codes are listed in Table 6-1.

Table 6-1. Manufacture's Code.

MFR NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
0003J	NIPPON ELECTRIC CO			
00853	SANGAMO ELEC CO S CAROLINA DIV	PICKENS	SC	29671
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01281	TRW INC SEMICONDUCTOR DIV	LAWNDALE	CA	90260
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
0192B	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	08876
02111	SPECTROL ELECTRONICS CORP	CITY OF IND	CA	91745
03508	GE CO SEMICONDUCTOR PROD DEPT	SYRACUSE	NY	13201
03888	KDI PYROFILM CORP	WHIPPANY	NJ	07981
04222	AVX CERAMICS CORP	MYRTLE BEACH	SC	29577
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85062
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
12617	HAMLIN INC	LAKE MILLS	WI	53551
13606	SPRAGUE ELECT CO SEMICONDUCTOR DIV	CONCORD	NH	03301
17856	SILICONIX INC	SANTA CLARA	CA	95054
19701	MEPCO/ELECTRA CORP	MINERAL WELLS	TX	76067
20932	EMCON DIV ITW	SAN DIEGO	CA	92129
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
25088	SIEMENS CORP	ISELIN	NJ	08830
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
27777	VARO SEMICONDUCTOR INC	GARLAND	TX	75040
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
32293	INTERSIL INC	CUPERTINO	CA	95014
34649	INTEL CORP	MOUNTAIN VIEW	CA	95051
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
71590	CENTRALAB ELEK DIV GLOBE-UNION INC	MILWAUKEE	WI	50501
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC	CT	06226
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA	PA	19108
75915	LITTELFUSE INC	DES PLAINES	IL	60016
84411	TRW CAPACITOR DIV	OGALLALA	NE	69153

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	Q	= transistor	V	= vacuum tube, photocell, etc.
B	= motor	FL	= filter	R	= resistor	W	= cable
BT	= battery	HR	= heater	RT	= thermistor	X	= socket
C	= capacitor	J	= jack	S	= switch	XDS	= lampholder
CP	= coupler	K	= relay	T	= transformer	XF	= fuseholder
CR	= diode	L	= inductor	TB	= terminal board	Y	= crystal
DL	= *delay line*	M	= *meter*	TC	= *thermocouple*	Z	= network
DS	= device signaling (lamp)	MP	= mechanical part	TP	= test point		
E	= miscellaneous electronic part	P	= plug				

ABBREVIATIONS *

A	= amperes	fil hd	= fillister head	n	= nano (10^{-9})	rot	= rotary
ACC	= accessories	flm	= film	NC	= normally closed		
AFC	= automatic frequency control	FR	= *front*	Ne	= neon	s-b	= slow-blow
Al	= aluminum	fwd	= forward	NETWRK	= network	scon	= semiconductor
AMP	= amplifier	fxd	= fixed	Ni Pl	= nickel plate	Se	= selenium
as ord	= as ordered			NO	= normally open	sect	= section(s)
		G c/s	= gigacycles per second (see G Hz)	NPN	= negative positive negative	SEMS	= machine screw with washer
Be Cu	= beryllium copper			NPO	= negative positive zero (zero temperature coefficient)	SEQ	= sequential
BFO	= beat frequency oscillator	Ge	= germanium			Si	= silicon
bh	= binder head	GEN	= generator			sil	= silver
bp	= bandpass	G Hz	= gigacycles per second	nsr	= not separately replaceable	sl	= slide
brs	= brass	gl	= glass			SPDT	= single-pole double-throw
		grd	= ground(ed)	obd	= order by description		
c/s	= cycles/second (see Hz)			od	= outside diameter	spl	= special
CALIB	= calibration	h	= henry(ies)	ov hd	= oval head	SPST	= single-pole single-throw
ccw	= counterclockwise	hex	= hexagonal	ox	= oxide		
cd pl	= cadmium plate	Hg	= mercury			sst	= stainless steel
cer	= ceramic	Hz	= cycle per second	pc	= printed circuit board	SWTCH	= switch
ch	= channel			PEMS	= circular press fitted nut		
cmo	= cabinet mount only	impg	= impregnated	pF	= picofarad (10^{-12} farads)	Ta	= tantalum
coef	= coefficient	incd	= incandescent	PH	= phone	td	= time delay
com	= common	ins	= insulation(ed)	ph brz	= phosphor bronze	Ti	= titanium
comp	= composition	ips	= inches per second	Phl hd	= Phillips head	tog	= toggle
conn	= connector			piv	= peak inverse voltage	tol	= tolerance
CRT	= cathode-ray tube	k, K	= kilo (1000)	pk	= peak	trim.	= trimmer
cw	= clockwise	Kc, k c/s	= kilocycles (see k Hz)	PNL	= panel	twt	= traveling wave tube
		KEPS	= hex nut with lockwasher	PNP	= positive negative positive		
dB	= decibel	k Hz	= kilocycles/second	poly	= polystyrene		
dep C	= deposited carbon			por	= porcelain	μor U	= *micro* (10^{-6})
DISP	= display	lin	= linear taper	pos	= position(s)	μA	= microamperes
DPDT	= double-pole double-throw	lkwash	= lockwasher	pot	= potentiometer	μF	= microfarads
DPST	= double-pole single-throw	log	= logarithmic taper	pp	= peak-to-peak	μV	= microvolts
		lp flt	= low-pass filter	PREAMP	= preamplifier		
EIA	= tubes or transistors meeting Electronic Industries Association standards will normally result in instrument operating *within specifications*. tubes and transistors selected for best performance will be supplied if ordered by stock numbers			prec	= precision (temperature coefficient, long term stability, and/or tolerance)	V	= volt(s)
		m	= milli (10^{-3})			vac	= vacuum
		mA	= milliamperes			Vacw	= volt(s) alternating current working
		mam	= milliammeter			var	= variable
		M	= *mega* (10^{6})	pt	= point	Vdcw	= volt(s) direct current working
		M c/s	= megacycles (see M Hz)				
		met flm	= metal film	rec	= recorder		
		mfr	= manufacturer	rect	= rectifier	W	= watt(s)
		mH	= millihenry	rev	= reverse	w/	= with
elect	= electrolytic	M Hz	= megacycles/second	rf	= radio frequency	w/o	= without
encap	= encapsulated	minat	= miniature	rh	= round head	wiv	= reverse working voltage
		mom	= momentary	rmo	= rack mount only		
F	= farad(s)	mtg	= mounting	rms	= root-mean-square	ww	= *wirewound*
fet	= *field effect transistor*	mV	= millivolt			Ω	= ohm
fh	= flat head	mW	= milliwatt				
FIG	= figure	my	= mylar ® (Dupont de Nemours)				

Electric Accounting Machines (EAM) capitalize all abbreviations

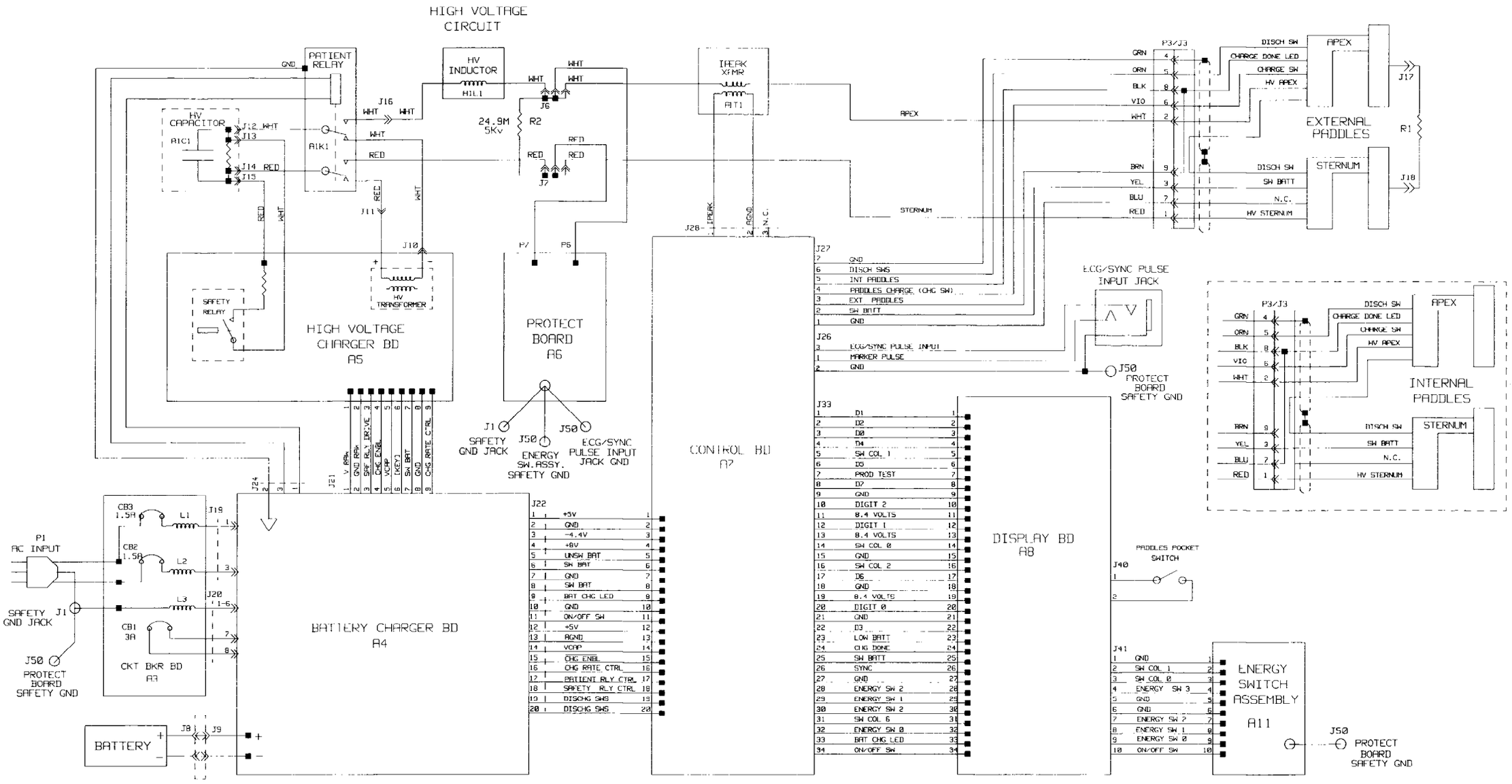
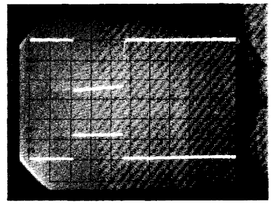
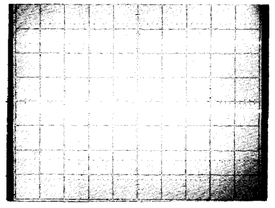


Figure 6-1. 43130A System Block Diagram.

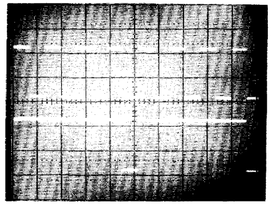


MARKER — QRS DETECTED 5V 5mS
PULSE J26-1 — TRIGGERED ON 5V 5mS
MARKER — U61-10 IN DELAY
U61-10 — MODE 320mS

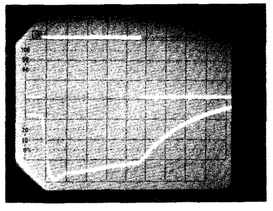


U61-12 — EXT. TRIG. ON — 2V/DIV — 50uS/DIV
INTR OR INTO — U62-1

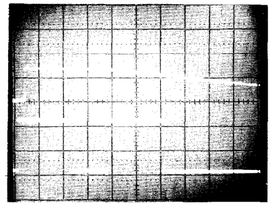
U63-2
ADCS OR CS — 2V/DIV



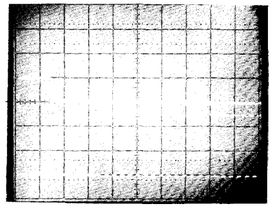
U61-9 — IF U61 FAILS — U61-9 MAY — 2V/DIV — 10mS/DIV
TICKLE — TO TICKLE U62, — LOOK LIKE
THE RESET — EITHER OF
SIGNAL — THESE.
(CONRST) TO



INPUT J26-3 — ECG/SYNC — 1V — 20mS
OUTPUT U63-5 — BUFFER U65B — 1V — 20mS
INPUT 100mS
WIDE SQUARE
PULSE. TRIG-
GERED ON J26-3
IN DELAY MODE
600mS

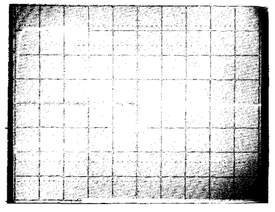


U64-13 — EXT. TRIG. — 2V/DIV — 20mS/DIV
IPEAK — ON U62-61
PICTURE
U61-9 — SHOWS THE — 2V/DIV
CON RST — SEQUENCE OF
EVENT AT
DISCHARGE.



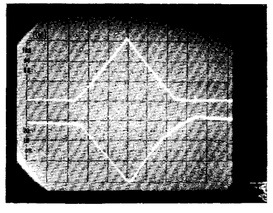
U61-6 — EXT. TRIG. ON — 2V/DIV — 200uS/DIV
CHG ENBL — U62-59

U62-60 — 2V/DIV
CHG FREQ OR
CHG RATE
CNTRL

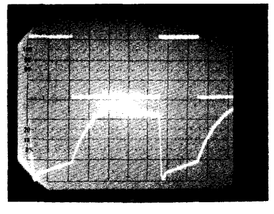


U63-3 — UNIT CHARGED — 1V/DIV — 50uS/DIV
CHANNEL 1 — TO 20J

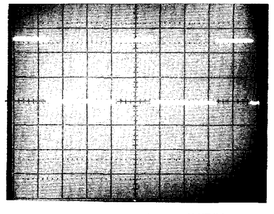
U61-8 — 2V/DIV
P1.7 OR GAIN
SELECT



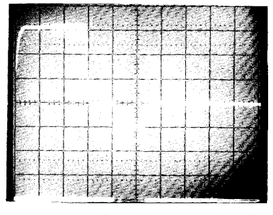
INPUT J26-3 — ECG/SYNC — 1V — 20mS
OUTPUT U63-5 — BUFFER U65B. — 1V — 20mS
INPUT 100mS
WIDE TRIANGLE 6
PULSE. TRIG-
GERED ON J26-3
IN DELAY MODE
570mS.



INPUT J26-3 — ECG/SYNC — 1V — 50mS
OUTPUT U63-5 — BUFFER U65B — 1V — 50mS
INPUT 100mS
WIDE SQUARE
PULSE.

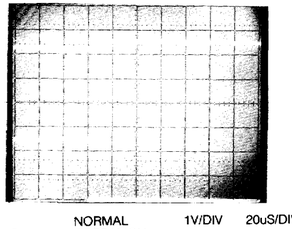


U62-1 — U61 OPERATING — 2V/DIV — 1mS/DIV
TICKLE — UNDER NORMAL
CONDITIONS.
SOFTWARE IS — 2V/DIV
EXECUTED
WHILE SIGNAL
IS HIGH.



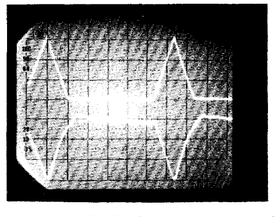
U63-3 — UNIT CHARGED — 1V/DIV — 50uS/DIV
CHANNEL 1 — TO 20J

U61-7 — 2V/DIV
P1.6 OR
ANALOG
SELECT

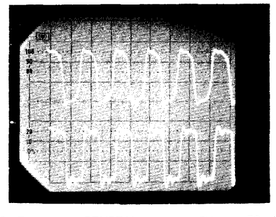


U63-4 — NORMAL — 1V/DIV — 20uS/DIV
CHANNEL 2 — OPERATION

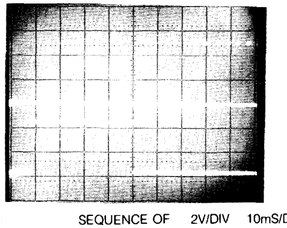
U61-7 — 2V/DIV
P1.6 OR
ANALOG
SELECT



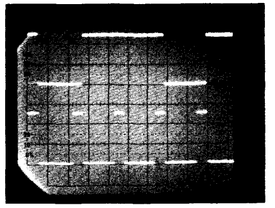
INPUT J26-3 — ECG/SYNC — 1V — 50mS
OUTPUT U63-5 — BUFFER U65B — 1V — 50mS
INPUT 100mS
WIDE TRAINGLE
PULSE.



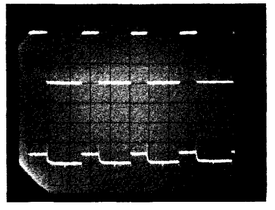
XTALOUT — CRYSTAL — 2V — 50mS
U62-7 — OSCILLATOR — 2V — 50mS
XTAL2 U61-18 — PROCESSOR
CLOCK — 2V



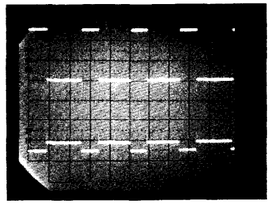
U62-1 — SEQUENCE OF — 2V/DIV — 10mS/DIV
TICKLE — EVENTS AT
TURN-ON.
U61-9 — EXT. TRIGGERED — 2V/DIV
CON RST — ON J33-16



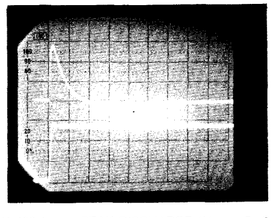
DIGIT 0 U61-15 — 2V — 2mS
TICKLE U62-1 — 2V — 2mS



DIGIT 0 U2-4 — '0'J DISPLAYED — 2V — 2mS
DIGIT 0 U2-13 — ON FRONT PANEL — 2V — 5mS

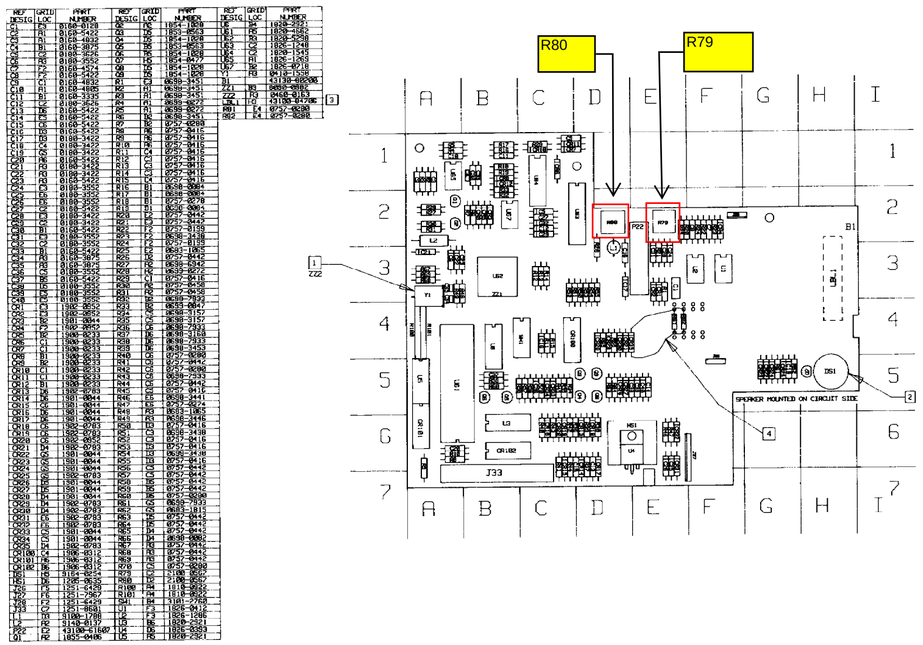


DIGIT 0 U2-4 — '360'J DISPLAYED — 2V — 5mS
DIGIT 0 U2-13 — ON FRONT PANEL — 2V — 5mS



1 PEAK J28-1 — PEAK DISCHARGE — 1V — 5mS
1 PEAK U64-13 — CURRENT — 1V — 5mS
DETECTOR

Figure 6-2. Control Board Waveforms.



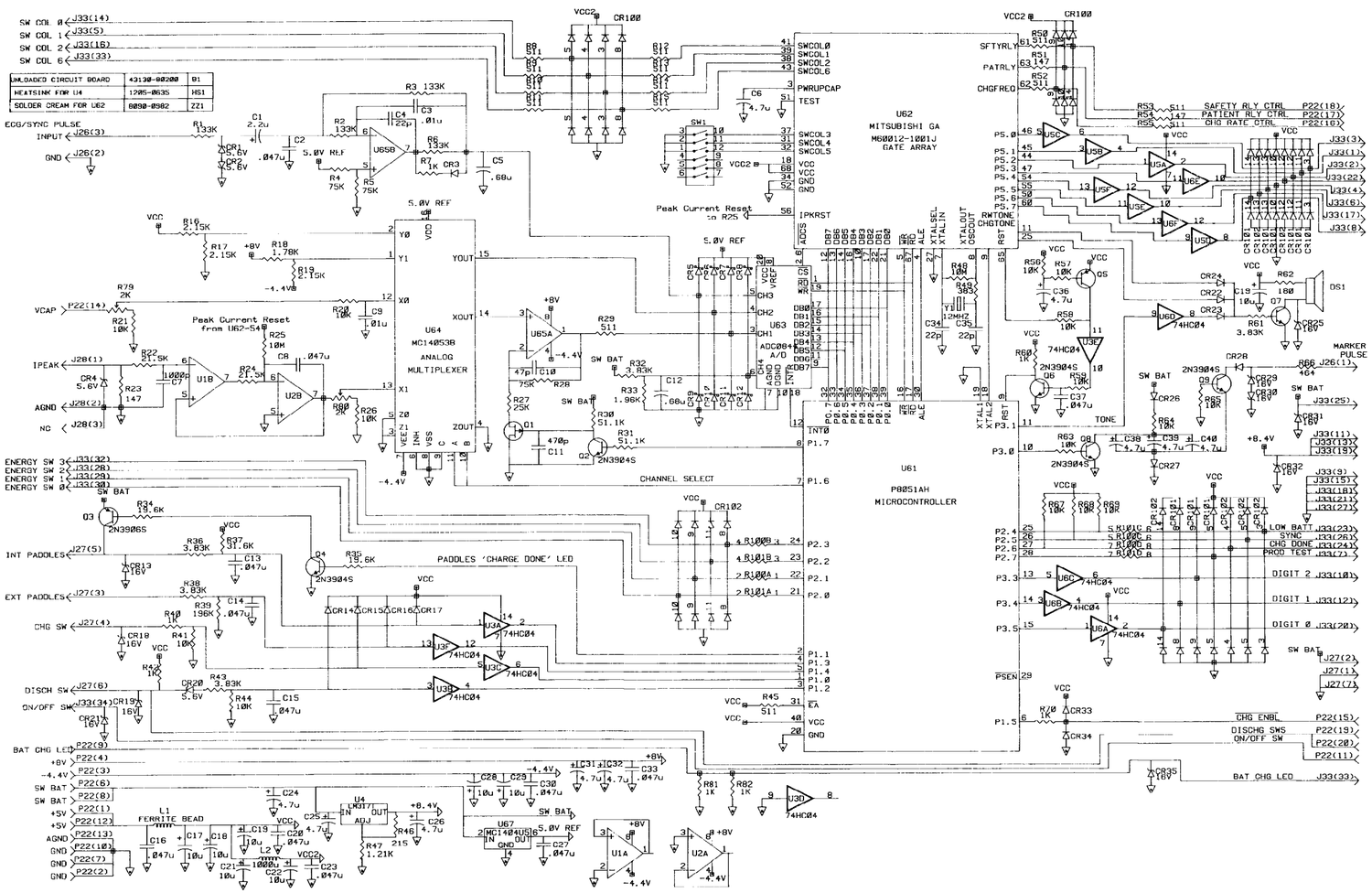


Figure 6-3. Schematic, Control Board.

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-CNTL BRD		43130-60200		1 OF

DIV.	PEG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P	85-10-29	91-04-08	1151	

YIELD	SPECIAL INSTRUCTIONS	FIND NUMBER	KIT	FD. I	FD. P	FEATURE CODE	ITEM NO.	REFERENCE DESIGNATOR (FIRST SM)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	U/C	QUANTITY PER	U/M	POLICY P / ISSUE	ALTERNATE DELIVER TO
	FN+0							01C1	CAP 2.2UF 20%		0160-0128		4	+1.0000		YREQ	
	FN+0							01C11	CAP 470PF 10%		0160-3335		M	+1.0000		YREQ	
	FN+0							01C4,34,35	CAP 22PF 5% 200V		0160-3875		M	+3.0000		YREQ	
	FN+0							01C7	CAP 1000PF 10%		0160-4574		M	+1.0000		YREQ	
	FN+0							01C10	CAP 47PF 5% 100V		0160-4805		M	+1.0000		YREQ	
	FN+0							01C3,9	CAP .01UF 10%		0160-4832		M	+2.0000		YREQ	
	FN+0							01C2,8,13-16,20,23 02C27,30,33,37	CAP .047UF 20%		0160-5422		M	+12.0000		YREQ	
	FN+0							01C17,18,19,21,22,28,29	C-F 10UF 10V TA		0180-3422		M	+7.0000		YREQ	
	FN+0							01C6,24,25,26,31,32 02C36,38,39,40	CAP-FIXED 4.7UF		0180-3552		M	+10.0000		YREQ	
	FN+0							01C5,12	C-F .68UF 25V TA		0180-3626		M	+2.0000		YREQ	
	FN+0							01Y1	XTAL 12.00 MHZ		0410-1558		M	+1.0000		YREQ	
	FN+0IN							01ZZ2	TAPE-YEL PLSTC		0460-0163		M	+0.0000	RL	NEIN	
	FN+0							01R25,48	RES 10M 5% .25W		0683-1065		M	+2.0000		YREQ	
	FN+0							01R62	RES 180 5% .25W		0683-1815		M	+1.0000		YREQ	
	FN+0							01R66	RES 464 1% .125W		0698-0082		M	+1.0000		YREQ	
	FN+0							01R16,17,19	RES-2.15K 1% .12		0698-0084		M	+3.0000		YREQ	
	FN+0							01R34,35	RES 19.6K		0698-3157		M	+2.0000		YREQ	
	FN+0								RES-31.6K 1% .12		0698-3160 PART NO CONT		M	+1.0000		YREQ	

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-CNTL BRD		43130-60200		2 OF

DIV.	PEG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P	85-10-29	91-04-08	1151	

YIELD	SPECIAL INSTRUCTIONS	FIND NUMBER	KIT	FD. I	FD. P	FEATURE CODE	ITEM NO.	REFERENCE DESIGNATOR (FIRST SM)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	U/C	QUANTITY PER	U/M	POLICY P / ISSUE	ALTERNATE DELIVER TO
								01R37	PART NO CONT		0698-3160						
	FN+0							01R23,51,54	RES 147 1% .125W		0698-3438		M	+3.0000		YREQ	
	FN+0							01R46	RES 215 1% .125W		0698-3441		M	+1.0000		YREQ	
	FN+0							0149	RES 383 1% 125W		0698-3446		M	+1.0000		YREQ	
	FN+0							01R1,2,3,6	RES-133K 1% .125		0698-3451		M	+4.0000		YREQ	
	FN+0							01R39	RES-196K 1% .125		0698-3453		M	+1.0000		YREQ	
	FN+0							01R27	RES 25K .1%		0698-6942		M	+1.0000		YREQ	
	FN+0							01R32,36,38,43,61	RES 3.83 .1%		0698-7933		M	+5.0000		YREQ	
	FN+0							01R4,5,28	RES-75K .1% .125		0699-0272		M	+3.0000		YREQ	
	FN+0							01R33	RES 1.96 .1%		0699-0847		M	+1.0000		YREQ	
	FN+0							01R22,24	RES-21.5K 1% .12		0757-0199		M	+2.0000		YREQ	
	FN+0							01R47	RES-1.21K 1% .12		0757-0274		M	+1.0000		YREQ	
	FN+0							01R18	RES-1.78K 1% .12		0757-0278		M	+1.0000		YREQ	
	FN+0							01R7,40,42,60,70,81,82	RES-1K 1% .125W		0757-0280		M	+7.0000		YREQ	
	FN+0							01R8-15,29,45,50 02R52,53,55	RES-.511K 1% .12		0757-0416		M	+14.0000		YREQ	
	FN+0							01R20,21,26,41,44,56-59 02R63,64,65,67,68,69	RES-10K 1% .125		0757-0442		M	+15.0000		YREQ	
	FN+0							01R30,31	RES-51.1K 1% .12		0757-0458		M	+2.0000		YREQ	
	FN+0								HEATSINK		1205-0635 PART NO CONT		M	+1.0000		YREQ	

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-CNTL BRD		43130-60200		3 OF

DIV.	PEG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P	85-10-29	91-04-08	1151	

YIELD	SPECIAL INSTRUCTIONS	FIND NUMBER	KIT	FD. I	FD. P	FEATURE CODE	ITEM NO.	REFERENCE DESIGNATOR (FIRST SM)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	U/C	QUANTITY PER	U/M	POLICY P / ISSUE	ALTERNATE DELIVER TO
								01HS1	PART NO CONT		1205-0635						
	FN+0							01J26,28	CONN-POST-3PIN		1251-6429		M	+2.0000		YREQ	
	FN+0							01J27	CONN-POST-7PIN		1251-7967		4	+1.0000		YREQ	
	FN+0							01J33	CONN-POST-34PIN		1251-8601		4	+1.0000		YREQ	
	FN+0							01R100,101	NETWORK-RES SIP		1810-0922		M	+2.0000		YREQ	
	FN+0							01U64	IC 4053B		1820-1545		M	+1.0000		YREQ	
	FN+0							01U3,5,6	IC MM74HC04N		1820-2921		M	+3.0000		YREQ	
	FN+0							01U61	IC MPU 8051		1820-4662		M	+1.0000		YREQ	
	FN+0							01U62	ASIC-COS-G-ARRAY		1820-5298		M	+1.0000		YREQ	
	FN+0							01U4	IC LM317T		1826-0393		M	+1.0000		YREQ	
	FN+0							01U1	IC 393		1826-0412		M	+1.0000		YREQ	
	FN+0							01U67	IC MC1404U5		1826-0718		M	+1.0000		YREQ	
	FN+0							01U63	IC-CONVERTER		1826-1248		M	+1.0000		YREQ	
	FN+0							01U65	IC-LIN OP AMP		1826-1269		M	+1.0000		YREQ	
	FN+0							01U2	OP AMP DUAL CMOS		1826-1286		M	+1.0000		YREQ	
	FN+0							01Q3,5	XSTR PNP SI		1853-0563		M	+2.0000			
	FN+0							01Q7	XSTR-NPN 2N2222A		1854-0477		M	+1.0000		YREQ	
	FN+0							01Q2,4,6,8,9	XSTR NPN SI		1854-1028		M	+5.0000			
	FN+0								J-FET P-CHANNEL		1855-0406 PART NO CONT		M	+1.0000		YREQ	

MATERIAL LIST

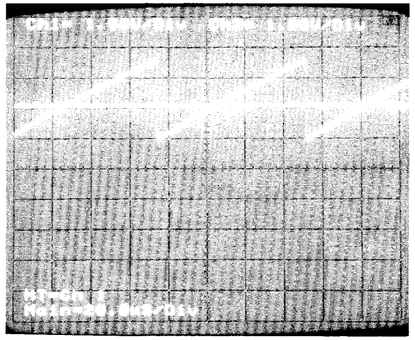
HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-CNTL BRD		43130-60200		4 OF

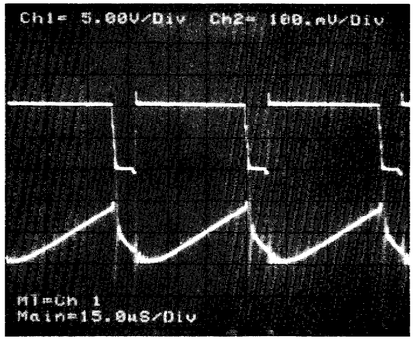
DIV.	MFG. SPECS.	LIT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P	85-10-29	91-04-08	1151	

YIELD	DEFECT	PHANTOM	EXPLODED	RT.	FD.	EXPLODE PHANTOM	ITEM NO.	REFERENCE DESIGNATOR (FIRST SMA)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P = ISSUE	ALTERNATE DELIVER TO
							01	Q1	PART NO CONT		1855-0406						
		PN+0					05	CR5-12	DIO-1N5711		1900-0233		M	+8.0000			
		PN+0					01	CR3,14-17,22,23,24	DIO-SWITCHING		1901-0044		M	+13.0000		YREQ	
							02	C26,27,28,33,34									
		PN+0					01	CR13,18,19,21,25	DIO-ZNR 16V 5%		1902-0783		M	+10.0000		YREQ	
							02	CR29,30,31,32,35									
		PN+0					01	CR1,2,4 20	DIO-ZNR 5.6V 5%		1902-0952		M	+4.0000		YREQ	
		PN+0					01	CR100,101,102	DIODE-MULTIPLE		1906-0312		M	+3.0000		YREQ	
		PN+0					01	R79,80	RES-TRMR 2K 10%		2100-0567		M	+2.0000		YREQ	
		PN+0					01	SW1	DIP SWITCH		3101-2760		M	+1.0000		YREQ	
		PN+0	RN				01	ZZ1	SOLDER CREAM		8090-0982		M	+2.0000	GR	NRIN	
		PN+0					01	L1	CORE-FERRITE		9100-1788		M	+1.0000		YREQ	
		PN+0					01	L2	COIL-1000UH 5%		9140-0137		M	+1.0000		YREQ	
		PN+0					01	DS1	AUDIO TRANSDUCER		9164-0254		M	+1.0000		YREQ	
		PN+0							CARRIER		9220-4576		M	+0.5000			
		PN+0							BAG-STAT SHLDED		9222-1396		M	+1.0000			
		PN+0					01	P22	CABLE-POWER		43100-61607		4	+1.0000		YREQ	
		PN+0	N						LABEL-BARCODE		43100-84706		M	+1.0000		N	
		PN+0					01	B1	PCB-CNTL BRD		43130-80200		M	+1.0000		YREQ	

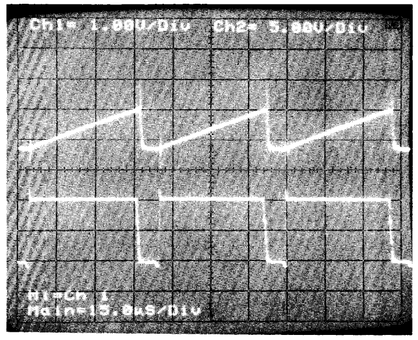
END OF MATERIAL LIST



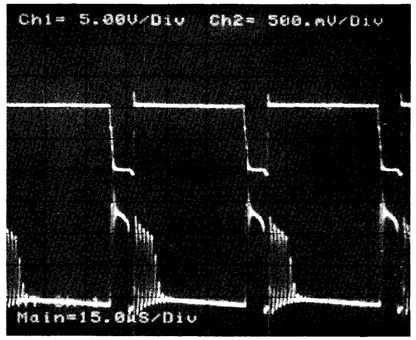
U1-7 F1 REMOVED; AFTER CHARGE
U1-9 BUTTON IS PUSHED



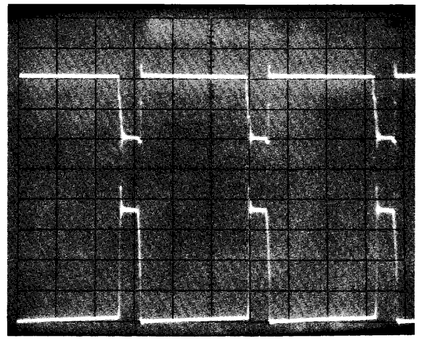
TP7 CHARGING NEAR 300J
U1-4
(w.r.t. U1-5)



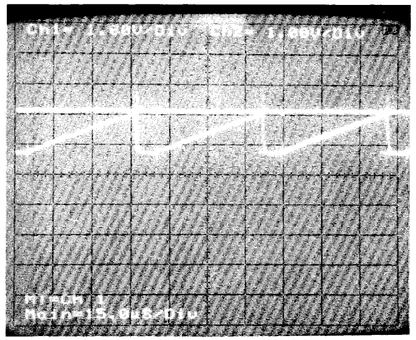
U1-7 CHARGING NEAR 300J
TP7



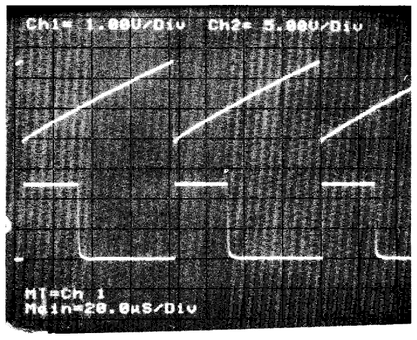
U2-3 CHARGING NEAR 300J
U2-2



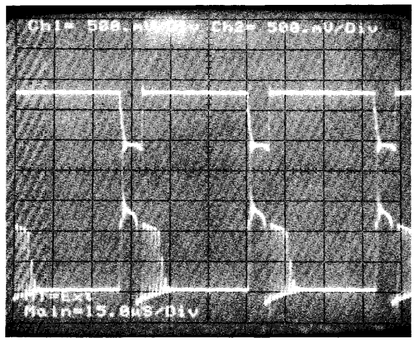
TP7 CHARGING NEAR 300J
TP9



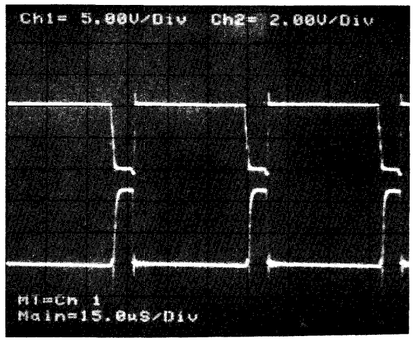
U1-7 CHARGING NEAR 300J
U1-9



U1-7 F1 REMOVED; AFTER CHARGE
TP7 BUTTON IS PUSHED



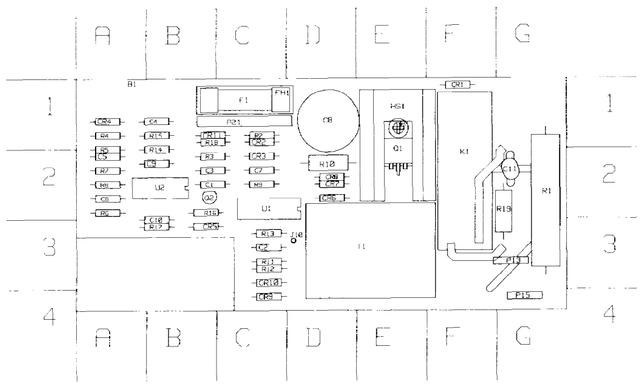
TP7 CHARGING NEAR 300J
U2-2



TP7 CHARGING NEAR 300J
TP3

Figure 6-4. High Voltage Charger Board Waveforms.

REF DESIG	GRID LOC	PART NUMBER
B1	B1	43100-60120
C1	B2	0160-5422
C2	C3	0160-3553
C3	B2	0160-4318
C4	B1	0160-4832
C5	A2	0160-3626
C6	A2	0160-5422
C7	C2	0160-5406
C8	D1	0180-2897
C9	B2	0180-3553
C10	B3	0160-5422
C11	C2	0160-5605
CR1	F3	1902-0783
CR2	C1	1901-0044
CR3	A2	1901-0044
CR4	A1	1902-0952
CR5	B3	1901-0841
CR6	B2	1902-1482
CR7	A2	1901-0044
CR8	B2	1902-0783
CR9	C4	1901-0620
CR10	C3	1901-0620
CR11	B1	1902-0952
F1	C1	2110-0048
FH1	C1	2110-0643
H1	E1	2360-0115
HS1	E1	1205-0508
J10	D3	1251-0600
K1	F2	43100-62830
P13	G3	43100-61622
P15	G4	43100-61619
P21	C1	43100-61620
Q1	E2	1855-0550
Q2	B2	1854-0017
R1	C2	0811-3705
R2	C1	0757-0442
R3	B2	0698-3156
R4	A1	0757-0123
R5	A2	0698-3468
R6	A2	0757-0280
R7	A2	0757-0442
R8	A2	0757-0442
R9	C2	0698-3438
R10	D2	0811-3705
R11	C3	0757-0698
R12	C3	0757-0280
R13	A3	0757-0442
R14	B2	0757-0442
R15	B1	0757-0280
R16	B2	0757-0442
R17	B3	0698-8824
R18	B1	0757-0280
R19	G2	0689-1015
T1	E3	43100-62700
U1	C2	1826-1656
U2	B2	1826-0424



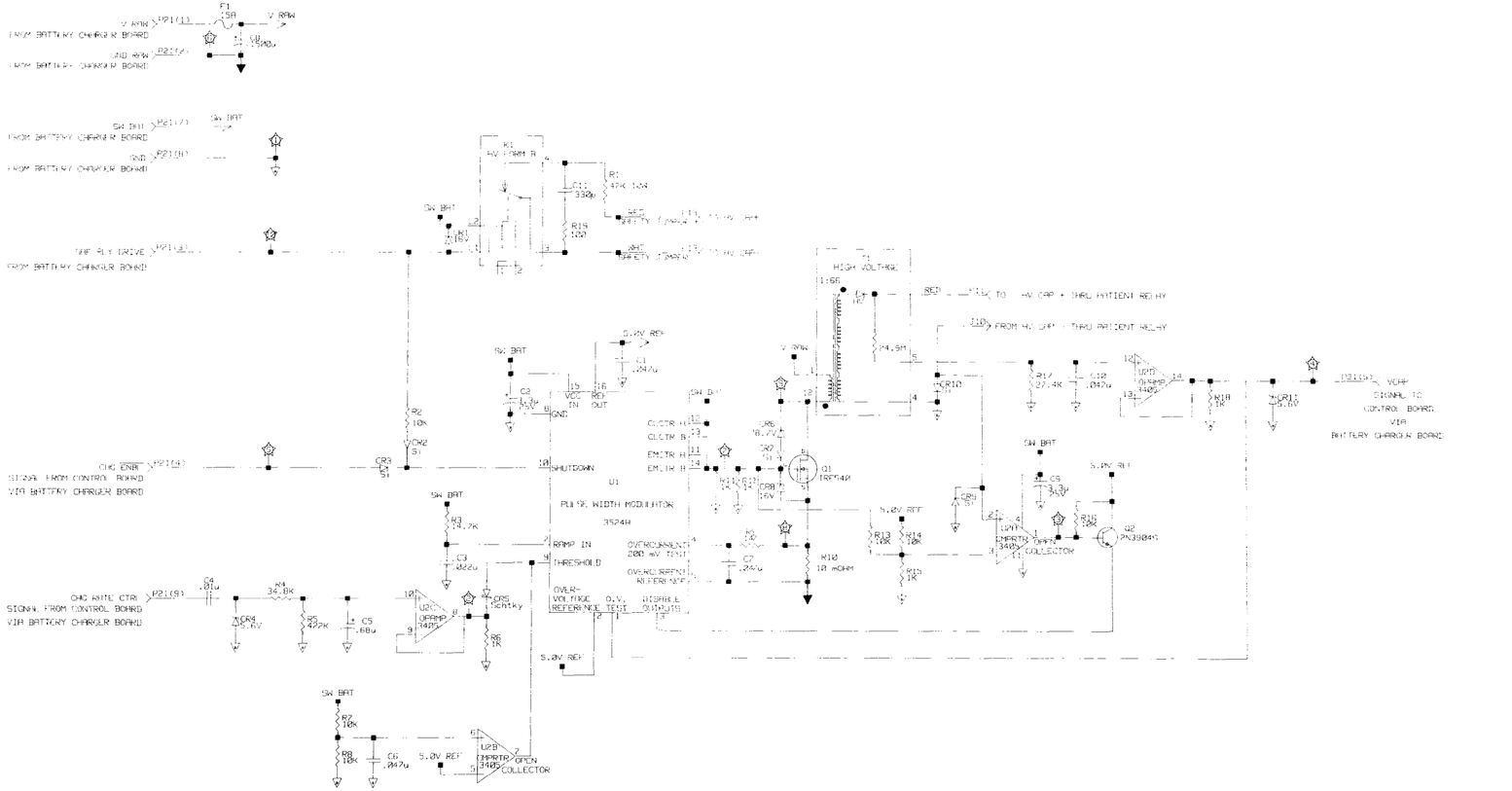


Figure 6-5. Schematic, High Voltage Charger Board.

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-HV CHGR		43100-60120		1F

DIV.	MFG SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		005	F	85-04-08	85-06-26	5263	304820 0

HELP	REFERENCE DESIGNATION (FIRST SEL)	PT.	ITEM NO.	PART DESCRIPTION	PARENT OPTION	PART NUMBER	CODE OPTION	QUANTITY PER	UM	POLICY F ISSUE	ALTERNATE DELIVER TO
		FY+0	N	CAP .01UF 10%		0160-4832		+1.0000			
	01C4										
		FY+0	N	CAP .022UF 10%		0160-4918		+1.0000			
	01C3										
		FY+0	N	CAP .047UF 20%		0160-5422		+4.0000			
	01C1,6,7,10										
		FY+0	N	HI VOLT CAP		0160-5605		+1.0000			
	01C11										
		FY+0	N	C-F 1500UF 25V		0180-2997		+1.0000			
	01C8										
		FY+0	N	CAP-FIXED 3.3UF		0180-3553		+2.0000			
	01C2,9										
		FY+0	N	CAP-FIXED-ELEC		0180-3626		+1.0000			
	01C5										
		FY+0	N	RES 100 5% 1W CC		0689-1015		+1.0000			
	01R19										
		FY+0	N	RES 14.7K 1%		0698-3156		+1.0000			
	01R3										
		FY+0	N	RES 133 1% .125W		0698-3437		+1.0000			
	01R9										
		FY+0	N	RES-422K 1% .UIW		0698-3460		+1.0000			
	01R5										
		FY+0	N	RES 27.4K .1%		0698-8804		+1.0000			
	01R17										
		FY+0	N	RES-34.8K 1% .12		0757-0123		+1.0000			
	01R4										
		FY+0	N	RES-1K 1% .125W		0757-0280		+5.0000			
	01R6,11,12,15,18										
		FY+0	N	RES-10K 1% .125		0757-0442		+6.0000			
	01R2,7,8,13,14,16										
		FY+0	N	RESISTOR, FIXED		0811-3705		+1.0000			
	01R10										
		FY+0	N	RESISTOR, FIXED		0811-3706		+1.0000			
	01R1										
		FY+0	N	HEAT SINK		1205-0600		+1.0000			
	01HS1										
		FY+0	N	CONTACT-CONN M		1251-0600		+1.0000			
						PART NO CONT					

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-HV CHGR		43100-60120		2F

DIV.	MFG SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		005	F	85-04-08	85-06-26	5263	304820 0

HELP	REFERENCE DESIGNATION (FIRST SEL)	PT.	ITEM NO.	PART DESCRIPTION	PARENT OPTION	PART NUMBER	CODE OPTION	QUANTITY PER	UM	POLICY F ISSUE	ALTERNATE DELIVER TO
	01U10			PART NO CONT		1251-0600					
		FY+0	N	IC 3405		1826-0424		+1.0000			
	01U2										
		FY+0	N	IC UC3524A-N		1826-1050		+1.0000			
	01U1										
		FY+0	N	XSTR-NPN SI		1854-0215		+1.0000			
	01Q2										
		FY+0	N	XSTR,PWR MOSFET		1855-0590		+1.0000			
	01Q1										
		FY+0	N	DIO-SWITCHING		1901-0044		+3.0000			
	01CR2,3,7										
		FY+0	N	DIO-SWITCHING		1901-0620		+2.0000			
	01CR9,10										
		FY+0	N	DIO-SCHOTTKY		1901-0841		+1.0000			
	01CR5										
		FY+0	N	DIO-ZNR 16V 5%		1902-0783		+2.0000			
	01CR1,8										
		FY+0	N	DIO-ZNR 5.6V 5%		1902-0952		+2.0000			
	01CR4,11										
		FY+0	N	DIO-ZNR 78.7V		1902-3400		+1.0000			
	01CR6										
		FY+0	N	FUSE-15A 32V		2110-0048		+1.0000			
	01F1										
		FY+0	N	FUHLR-CLIP TYPE		2110-0643		+1.0000			
	01FH1										
		FY+0	N	SCR-BH 6-32X.312		2360-0115		+1.0000			
	01H1										
		FY+0	N	CBL ASSY CHGR HV		43100-61600		+1.0000			
	01P21										
		YF8+0	N	JUMPER-SAFETY CK		43100-61619		+1.0000			
	01P15										
		YF8+0	N	CBL-SAFETY CKT		43100-61622		+1.0000			
	01P13										
		YF8+0	N	XFMR HV		43100-62700		+1.0000			
	01T1										
		YF8+0	N	SAFETY RELAY AY		43100-62830		+1.0000			
						PART NO CONT					

MATERIAL LIST

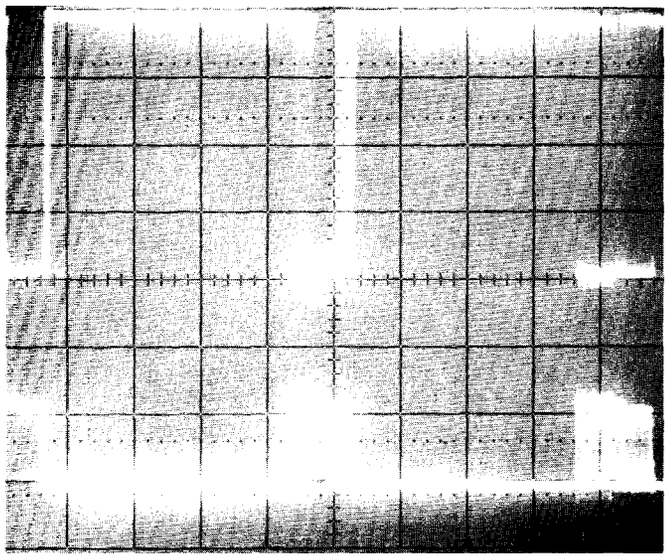
HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-HV CHGR		43100-60120		3F

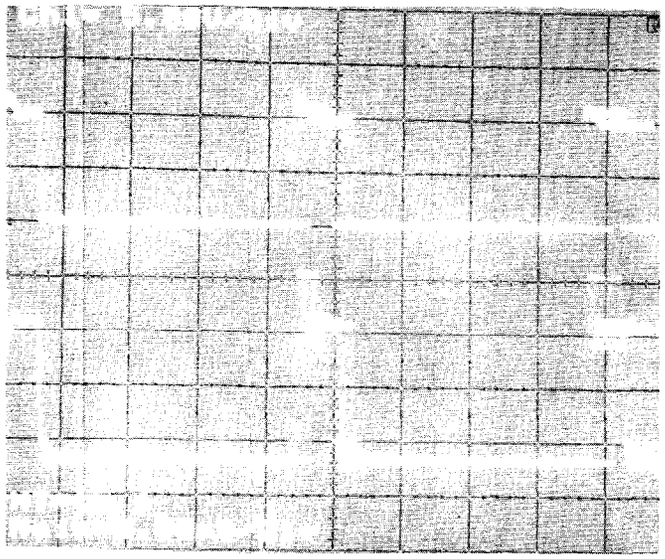
DIV.	MFG SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		005	F	85-04-08	85-06-26	5263	304820 0

HELP	REFERENCE DESIGNATION (FIRST SEL)	PT.	ITEM NO.	PART DESCRIPTION	PARENT OPTION	PART NUMBER	CODE OPTION	QUANTITY PER	UM	POLICY F ISSUE	ALTERNATE DELIVER TO
	01K1			PART NO CONT		43100-62830					
		FY+0	N	PC BOARD		43100-80120		+1.0000			
	01A1										

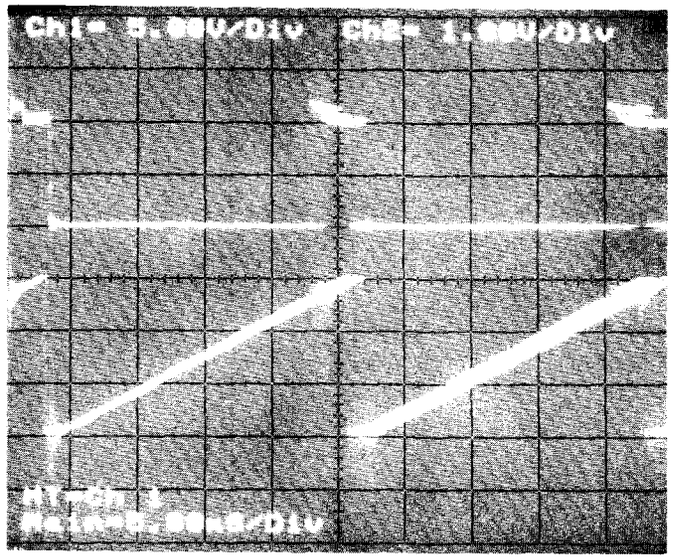
END OF MATERIAL LIST



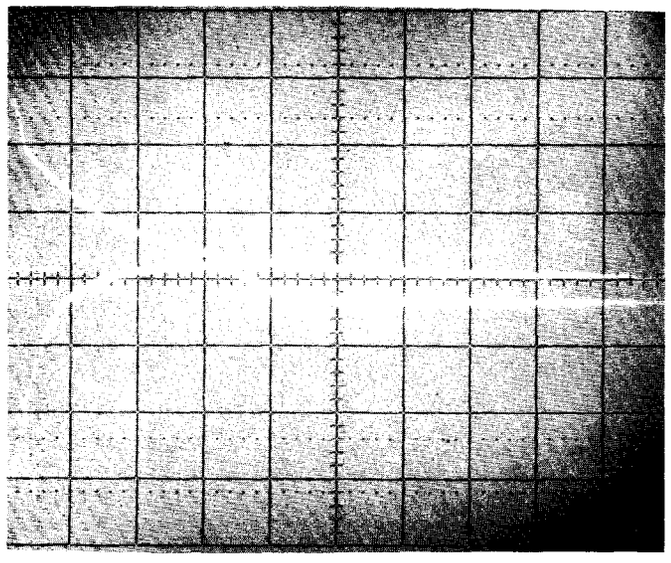
T1-2 (TP6) MONITOR ON. MUST USE 100V/DIV 5uS/DIV
U1-8 ISOLATION TRAMSFORMER 10V/DIV
FOR THESE PICTURES
TAHEN ON PRIMARY
CIRCUIT. ONLY W/
ISOLATION CAN SCOPE
GND BE CONNECTED W/
PRIMARY GND.



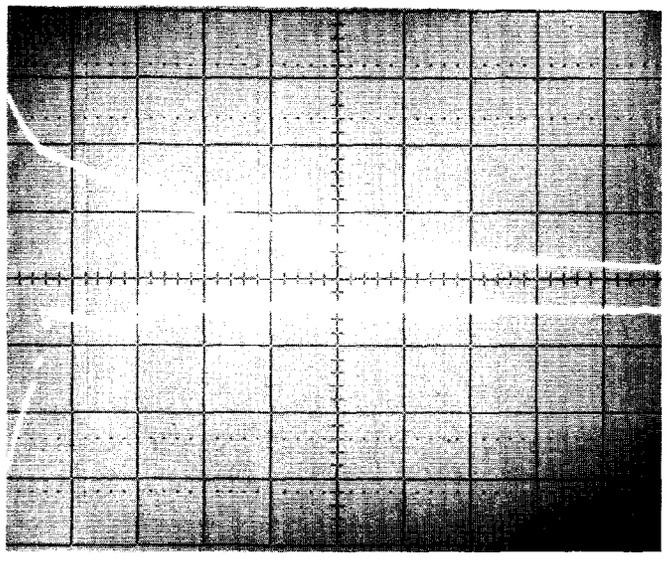
U1-8 MONITOR ON. 5V/DIV
T1-6 NORMAL OPERATION 50V/DIV



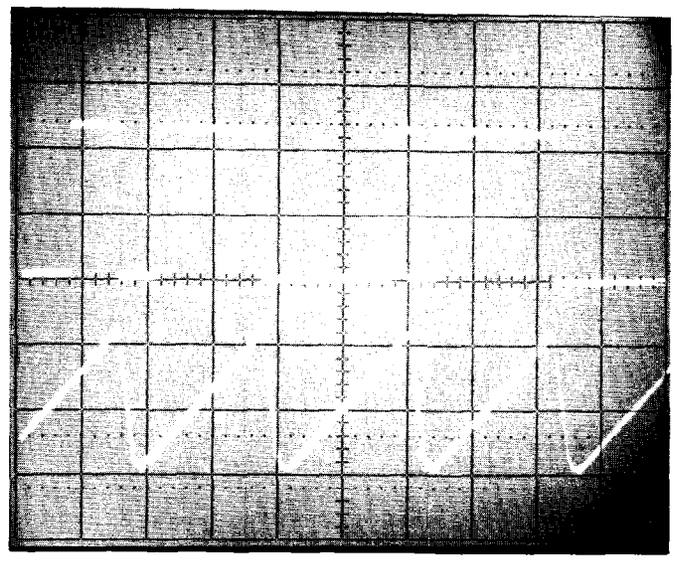
U1-8 MONITOR ON. NORMAL OPERATION
U1-5



Q5-CATHODE 1 OR 2 SECONDS 10V/DIV 0.5mS/DIV
U3-5 AFTER CONNECTION 1V/DIV
TO AC LINE WHEN
Q5 FIRES

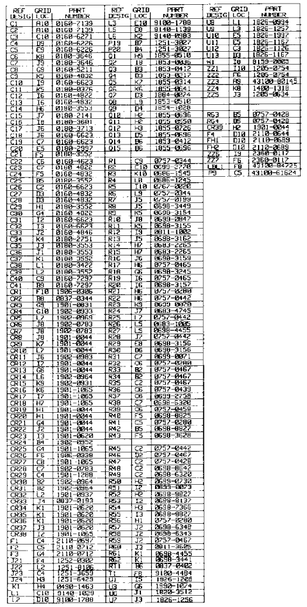


Q5-CATHODE 1 OR 2 SECONDS 10V/DIV 0.2mS/DIV
Vc-PRIM AFTER CONNECTION 5V/DIV
TO AC LINE WHEN
Q5 FIRES



U7-2 MONITOR ON. 5V/DIV 10uS/DIV
U7-3 NORMAL OPERATION 0.5V/DIV

Figure 6-6. Battery Charger Board Waveforms.



REF DES	GRID LOC	PART NUMBER
C1	A10	0160-7139
C2	A10	0160-7139
C4	C10	0160-4371
C5	D8	0160-4379
C6	D9	0160-5229
C7	K2	0160-5229
C8	F9	0160-3646
C9	G8	0160-3611
C10	K2	0160-4835
C11	F6	0160-6623
C12	J2	0160-0376
C13	J6	0160-4827
C14	J6	0160-4537
C15	J6	0160-3721
C16	J7	0160-3611
C17	J8	0160-4835
C18	J8	0160-4835
C19	J8	0160-3611
C20	J6	0160-6623
C21	K5	0160-6623
C22	K5	0160-4827
C23	K5	0160-4827
C24	K5	0160-4827
C25	K5	0160-4827
C26	K5	0160-4827

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION: PCA BATTERY CHRG | EDC NUMBER | MODEL OR ASSEMBLY NUMBER: 43100-60145 | OPTION | PAGE 1*

DIV. 30 | REG. SPECS. | L.C. 008 | PRIMARY MODEL P | RELEASE DATE | REVISION DATE 91-04-04 | CYCLE 1144 | DELIVER TO

YIELD	TYPE CODE	REF DES PREFIX	FIG. NO.	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEC)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	CORR. OPTION	U/M	QUANTITY PER	UPI	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	FN+0				01C22	CAP 3900PF 5%		0160-4623	M		+1.0000				
	FN+0				01C12,23,30	CAP 1000PF 5%		0160-4822	M		+3.0000				
	FN+0				01C9,13,24,27,28	CAP .01UF 10%		0160-4832	M		+5.0000				
	FN+0				01C33	CAP 1500PF 5%		0160-4846	M		+1.0000				
	FN+0				01C8	CAP .1UF 5% 250V		0160-5211	4		+1.0000				
	FN+0				01C4,5	CAP, CER		0160-6226	M		+2.0000				
	FN+0				01C3	CAPACITOR		0160-6271	M		+1.0000				
	FN+0				01C10,18,19,26,31,32	.1UF 20% 50V		0160-6623	M		+6.0000				
	FN+0				01C1,2	CAP .33uF 175V		0160-7139	M		+2.0000				
	FN+0				01C40,41	100PF CAP		0160-7297	M		+2.0000				
	FN+0				01C11	C-F .47UF 35V		0180-0376	M		+1.0000				
	FN+0				01C15	C-F 3.3UF 50V TA		0180-2141	M		+1.0000				
	FN+0				01C34	C-F 470UF 12V UL		0180-2751	M		+1.0000				
	FN+0				01C20	C-F 1500UF 25V		0180-2997	M		+1.0000				
	FN+0				01C38	C-F 10UF 10V TA		0180-3422	M		+1.0000				
	FN+0				01C21,25,29,37,39	CAP-FIXED 4.7UF		0180-3552	M		+5.0000				
	FN+0				01C14,35,36	CAP-FIXED 3.3UF		0180-3553	M		+3.0000				
	FN+0				01C16	CAP 22uF 100V		0180-3601	M		+1.0000				
	FN+0					CAP-FXD-ELCTLT		0180-3646 PART NO CONT	M		+2.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION: PCA BATTERY CHRG | EDC NUMBER | MODEL OR ASSEMBLY NUMBER: 43100-60145 | OPTION | PAGE 2*

DIV. 30 | REG. SPECS. | L.C. 008 | PRIMARY MODEL P | RELEASE DATE | REVISION DATE 91-04-04 | CYCLE 1144 | DELIVER TO

YIELD	TYPE CODE	REF DES PREFIX	FIG. NO.	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEC)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	CORR. OPTION	U/M	QUANTITY PER	UPI	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
					01C6,7	PART NO CONT		0180-3646							
	FN+0				01C17	CAP-FIXED		0180-3713	M		+1.0000				
	FN+0				01K1	RELAY SPST		0490-1463	M		+1.0000				
	FN+0				01R26	RES-10 OHM 5%		0683-1005	M		+1.0000				
	FN+0				01R14,15	RES 22M 5% .25W		0683-2265	M		+2.0000				
	FN+0				01R24	RES 470K 5% .25W		0683-4745	M		+1.0000				
	FN+0				01R4	RES-120K 5% .5W		0686-1245	M		+1.0000				
	FN+0				01R3	RES-150K 5% .5W		0686-1545	M		+1.0000				
	FN+0				01R9	RES-4.22K 1% .12		0698-3154	M		+1.0000				
	FN+0				01R11	RES-4.64K 1% .12		0698-3155	M		+1.0000				
	FN+0				01R29,30	RES 14.7K 1%		0698-3156	M		+2.0000				
	FN+0				01R20	RES 19.6K		0698-3157	M		+1.0000				
	FN+0				01R16	RES-26.1K 1% .12		0698-3159	M		+1.0000				
	FN+0				01R13	RES-46.4K 1% .12		0698-3162	M		+1.0000				
	FN+0				01R18	RES-20.5K 1% .12		0698-3245	M		+1.0000				
	FN+0				01R62	RES 215 1% .125W		0698-3441	M		+1.0000				
	FN+0				01R8	RES 28.7K .125W		0698-3449	M		+1.0000				
	FN+0				01R43	RES-.22K 5% 2W		0698-3628	M		+1.0000				
	FN+0					RES 536 1% .125W		0698-4455 PART NO CONT	M		+2.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION: PCA BATTERY CHRG | EDC NUMBER | MODEL OR ASSEMBLY NUMBER: 43100-60145 | OPTION | PAGE 3*

DIV. 30 | REG. SPECS. | L.C. 008 | PRIMARY MODEL P | RELEASE DATE | REVISION DATE 91-04-04 | CYCLE 1144 | DELIVER TO

YIELD	TYPE CODE	REF DES PREFIX	FIG. NO.	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEC)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	CORR. OPTION	U/M	QUANTITY PER	UPI	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
					01R27,61	PART NO CONT		0698-4455							
	FN+0				01R38,49	RES 5K.1% .125W		0698-6320	M		+2.0000				
	FN+0				01R58	RES 9K .1% .125W		0698-6343	M		+1.0000				
	FN+0				01R57	RES-3K .1% .125W		0698-6348	M		+1.0000				
	FN+0				01R54	RES 109 .64K .1%		0698-7366	M		+1.0000				
	FN+0				01R53	RES 9M 1% .125W		0698-8137	M		+1.0000				
	FN+0				01R48	RESISTOR-FIXED		0698-8642	M		+1.0000				
	FN+0				01R40	RES 681K 1% .125		0698-8825	M		+1.0000				
	FN+0				01R42,52,55	RESISTOR 1M		0698-8827	M		+3.0000				
	FN+0				01R23	RES 3.16M 1%		0699-0070	M		+1.0000				
	FN+0				01R31	RES 4.64M 1%		0699-0071	M		+1.0000				
	FN+0				01R51	RES 10M 1% .125W		0699-0073	M		+1.0000				
	FN+0				01R50	RES 1M .1% .125W		0699-0730	M		+1.0000				
	FN+0				01R10	RES 1.96 .1%		0699-0847	M		+1.0000				
	FN+0				01R37	RES 47 .28K 1%		0699-2758	M		+1.0000				
	FN+0				01R2	RES 4ohm 5% 5W		0699-2770	M		+1.0000				
	FN+0				01R7	RES-21.5K 1% .12		0757-0199	M		+1.0000				
	FN+0				01R21,32,41,56	RES-1K 1% .125W		0757-0280	M		+4.0000				
	FN+0					RES 1M 1% .25W		0757-0344 PART NO CONT	M		+2.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60145		4F

DIV.	REG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SPARE CODE	FIG.	ITEM NO.	REFERENCE DESIGNATOR (FIRST SER)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	U/M	QUANTITY PER	UPI	POLICY P - ISSUE	ALTERNATE DELIVER TO
					PART NO CONT		0757-0344						
				01R1,6									
	FN+0				RES 1.62K 1% 1/8		0757-0428		M	+3.0000			
				01R47,63,64									
	FN+0				RES 6.81K 1%		0757-0439		M	+1.0000			
				01R36									
	FN+0				RES-10K 1% .125		0757-0442		M	+4.0000			
				01R22,25,28,45									
	FN+0				RES-51.1K 1% .12		0757-0458		M	+1.0000			
				01R39									
	FN+0				RES-100K 1% .125		0757-0465		M	+2.0000			
				01R17,19									
	FN+0				RES-121K 1% .125		0757-0467		M	+5.0000			
				01R33,34,35,46,59									
	FN+0				RES 2.2K 5% 3W		0767-0020		M	+1.0000			
				01R5									
	FN+0				RES .68 1% 1PW		0811-1002		M	+1.0000			
				01R12									
	FN+0				RES .1 5% .5W PW		0811-3605		M	+1.0000			
				01R60									
	FN+0				SUPPRESS-VOLTAGE		0837-0193		M	+1.0000			
				01CR33									
	FN+0				DIO-V SUPPR		0837-0344		M	+1.0000			
				01CR2									
	FN+0				THERMISTOR 25K		0837-0402		M	+1.0000			
				01RT1									
	FN+0				HEAT SINK		1205-0634		M	+1.0000			
				01ZZ5									
	FN+0				HEAT SINK		1205-0754		M	+2.0000			
				01ZZ1,2									
	FN+0				CONN-POST TP-SKT		1251-3027		M	+2.0000			
				01P19,20									
	FN+0				CONN UTIL		1251-3659		M	+1.0000			
				01J23									
	FN+0				CONN-POST-3PIN		1251-6429		M	+1.0000			
				01J24									
	FN+0				CONN-POST-TP-HDR		1251-8106		M	+1.0000			
							PART NO CONT						

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60145		5F

DIV.	REG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SPARE CODE	FIG.	ITEM NO.	REFERENCE DESIGNATOR (FIRST SER)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	U/M	QUANTITY PER	UPI	POLICY P - ISSUE	ALTERNATE DELIVER TO
					PART NO CONT		1251-8106						
				01J22									
	FN+0				CONNECTOR		1252-0302		M	+1.0000			
				01J21									
	FN+0				CABLE TIE		1400-1318		4	+1.0000			
				01ZZ4									
	FN+0				IC ULN2061M		1820-3512		M	+1.0000			
				01U6									
	FN+0				IC LM337LZ		1826-0994		M	+1.0000			
				01U8									
	FN+0				IC LM392		1826-1126		M	+1.0000			
				01U12									
	FN+0				ICCT1004CZ		1826-1167		M	+2.0000			
				01U11,13									
	FN+0				IC MC34060P		1826-1208		M	+1.0000			
				01U1									
	FN+0				IC SWTCHG REGLTR		1826-1256		M	+1.0000			
				01U7									
	FN+0				IC +8V LIN REG		1826-1257		M	+1.0000			
				01U9									
	FN+0				IC OP290GP		1826-1997		M	+1.0000			
				01U10									
	FN+0				XSTR-2N3906		1853-0036		M	+1.0000			
				01Q2									
	FN+0				TRS SI PNP		1853-0217		M	+1.0000			
				01Q4									
	FN+0				XSTR PNP SI DARL		1853-0412		M	+2.0000			
				01Q3,14									
	FN+0				XSTR PNP		1853-0510		M	+1.0000			
				01Q8									
	FN+0				XSTR NPN SI		1854-1028		M	+1.0000			
				01Q9									
	FN+0				XSTR-2N6027		1855-0314		M	+1.0000			
				01Q5									
	FN+0				MOSFET N-CHAN		1855-0510		M	+1.0000			
				01Q1									
	FN+0				MOSFET P-CHAN		1855-0550		M	+1.0000			
							PART NO CONT						

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60145		6F

DIV.	REG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SPARE CODE	FIG.	ITEM NO.	REFERENCE DESIGNATOR (FIRST SER)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	U/M	QUANTITY PER	UPI	POLICY P - ISSUE	ALTERNATE DELIVER TO
					PART NO CONT		1855-0550						
				01Q11									
	FN+0				TRANS-MOSFET		1855-0641		M	+1.0000			
				01Q6									
	FN+0				TRANSISTOR		1855-0696		M	+3.0000			
				01Q10,13,15									
	FN+0				MOSFET P-CHAN		1855-0726		M	+1.0000			
				01Q12									
	FN+0				THYR-2N5060 SCR		1884-0074		M	+1.0000			
				01Q7									
	FN+0				DIO-SWITCHING		1901-0044		M	+10.0000			
				01CR8,9,10,12,13,19,10CR20/22,39									
	FN+0				DIO-SWITCHING		1901-0620		M	+5.0000			
				01CR23,34,35,36,37									
	FN+0				DIO-1N4937		1901-0831		M	+1.0000			
				01CR3									
	FN+0				DIODE, SCHOTTKY		1901-0937		M	+1.0000			
				01CR32									
	FN+0				DIO-1N4936		1901-1065		M	+6.0000			
				01CR16,17,18,25,27,38									
	FN+0				DIO-V-SUPPR		1901-1288		M	+1.0000			
				01CR29									
	FN+0				DIO-ZNR 16V 5%		1902-0783		M	+3.0000			
				01CR6,7,28									
	FN+0				DIO-2NR 120V 5%		1902-0931		M	+1.0000			
				01CR15									
	FN+0				DIO-ZNR 1N5370B		1902-0933		M	+1.0000			
				01CR4									
	FN+0				DIO-ZNR 5.6V 5%		1902-0952		M	+1.0000			
				01CR24									
	FN+0				DIO-ZNR 18V 5%		1902-0964		M	+3.0000			
				01CR14,30,31									
	FN+0				DIO-ZNR 30V 5%		1902-0969		M	+1.0000			
				01CR5									
	FN+0				DIO-ZNR IN4621		1902-0983		M	+1.0000			
				01CR11									

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60145		7 OF

DIV.	MFG. SPECS.	L.T.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SECT	SUBASSY	KIT	FD. I	FD. P	FOUND	CONV	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		PN+0								ERDG-DIO-600V		1906-0306			M +1.0000				
								01	CR1										
		PN+0								DIODE		1906-0338			M +1.0000				
								01	CR26										
		PN+0								OPTO-ISOLATOR		1990-1074			M +1.0000				
								01	U3										
		PN+0								FUSE, 1.6A, 250V		2110-0644			M +1.0000				
								01	F4										
		PN+0								FUSECLIP 5x20mm		2110-0689			M +2.0000				
								01	FH1,FH2										
		PN+0								FUSE 15A		2110-0697			M +1.0000				
								01	F1										
		PN+0								FUSE 4A		2110-0712			M +2.0000				
								01	F2,3										
		PN+0	RN							SCR-MACH 6-32X.3		2360-0117			4 +2.0000			NBIN	
								01	ZZ6,ZZ7										
		PN+0								RESISTOR- 0 OHM		8159-0005			M +1.0000				
								01	W1										
		PN+0								CORE-FERRITE		9100-1788			M +2.0000				
								01	L2,3										
		PN+0								XFMR-SWITCHING		9100-4484			M +1.0000				
								01	T1										
		PN+0								INDUCTOR		9140-0983			M +1.0000				
								01	L6										
		PN+0								INDUCTOR		9140-1029			M +1.0000				
								01	L1										
		PN+0								INDUCTOR-FIXED		9140-1139			M +1.0000				
								01	L5										
		PN+0								CARRIER		9220-4576			M +0.5000				
		PN+0								BAG-ANTI STATIC		9222-1367			M +1.0000				
	Y	PN+0								CBL-BATT TO PCB		43100-61624			4 +1.0000				
								01	P9										
		PN+0								PCB-BATTERY CHG		43100-80145			M +1.0000				
								01	ZZ3										
		PN+0								BAR CODE LABEL		43100-84725			M +1.0000				
								01	LBL1										

MATERIAL LIST

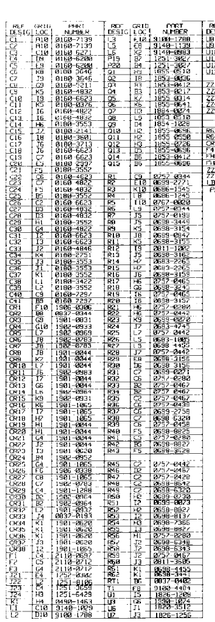
HEWLETT PACKARD

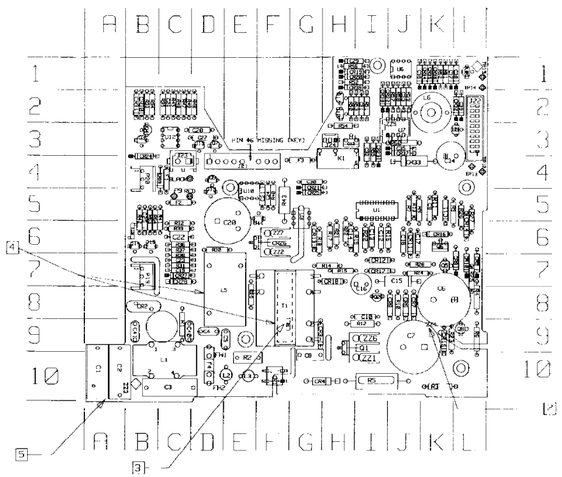
DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60145		8 OF

DIV.	MFG. SPECS.	L.T.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SECT	SUBASSY	KIT	FD. I	FD. P	FOUND	CONV	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO

END OF MATERIAL LIST





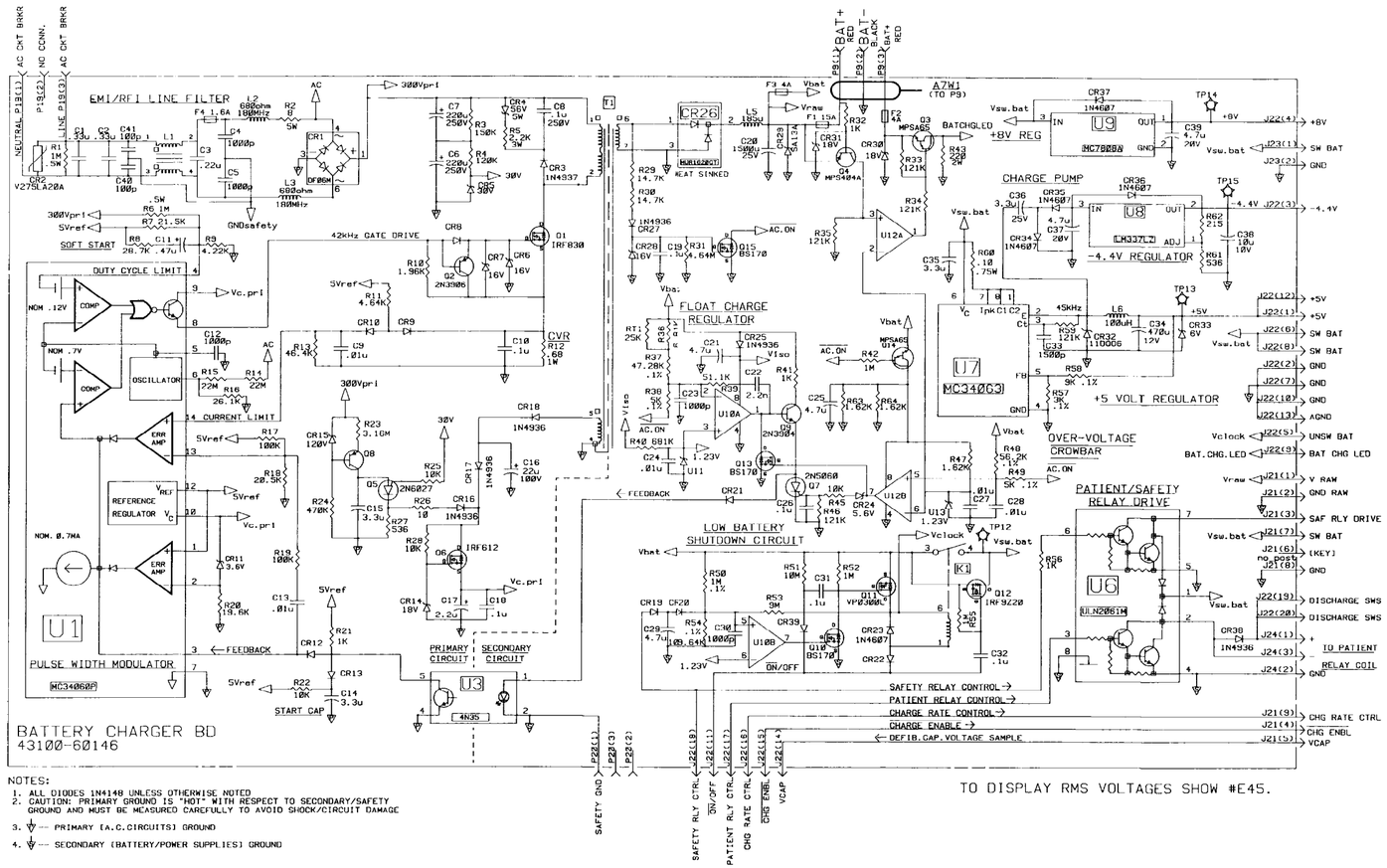


Figure 6-8. Schematic, Battery Charger Board.

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60146		1

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SPECIAL INSTRUCTIONS	FIX.	PT.	FEEDTHRU	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	D/C	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	FN+0					01C22	CAP 3900PF 5%		0160-4623		M	+1.0000				
	FN+0					01C12,23,30	CAP 1000PF 5%		0160-4822		M	+3.0000				
	FN+0					01C9,13,24,27,28	CAP .01UF 10%		0160-4832		M	+5.0000				
	FN+0					01C33	CAP 1500PF 5%		0160-4846		M	+1.0000				
	FN+0					01C8	CAP .1UF 5% 250V		0160-5211		4	+1.0000				
	FN+0					05C4,5	CAP,1000PF+-10%		0160-6200		M	+2.0000				
	FN+0					01C3	CAPACITOR		0160-6271		M	+1.0000				
	FN+0					01C10,18,19,26,31,32	.1UF 20% 50V		0160-6623		M	+6.0000				
	FN+0					01C1,2	CAP .33uF 175V		0160-7139		M	+2.0000				
	FN+0					01C40,41	100PF CAP		0160-7297		M	+2.0000				
	FN+0					01C11	C-F .47UF 35V		0180-0376		M	+1.0000				
	FN+0					01C15	C-F 3.3UF 50V TA		0180-2141		M	+1.0000				
	FN+0					01C34	C-F 470UF 12V UL		0180-2751		M	+1.0000				
	FN+0					01C20	C-F 1500UF 25V		0180-2997		M	+1.0000				
	FN+0					01C38	C-F 10UF 10V TA		0180-3422		M	+1.0000				
	FN+0					01C21,25,29,37,39	CAP-FIXED 4.7UF		0180-3552		M	+5.0000				
	FN+0					01C14,35,36	CAP-FIXED 3.3UF		0180-3553		M	+3.0000				
	FN+0					01C16	CAP 22uF 100V		0180-3601		M	+1.0000				
	FN+0						CAP-FXD-ELCTLT		0180-3646 PART NO CONT		M	+2.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60146		2

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SPECIAL INSTRUCTIONS	FIX.	PT.	FEEDTHRU	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	D/C	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
						01C6,7	PART NO CONT		0180-3646							
	FN+0					01C17	CAP-FIXED		0180-3713		M	+1.0000				
	FN+0					01K1	RELAY SPST		0490-1463		M	+1.0000				
	FN+0					01R26	RES-10 OHM 5%		0683-1005		M	+1.0000				
	FN+0					01R14,15	RES 22M 5% .25W		0683-2265		M	+2.0000				
	FN+0					01R24	RES 470K 5% .25W		0683-4745		M	+1.0000				
	FN+0					01R4	RES-120K 5% .5W		0686-1245		M	+1.0000				
	FN+0					01R3	RES-150K 5% .5W		0686-1545		M	+1.0000				
	FN+0					01R9	RES-4.22K 1% .12		0698-3154		M	+1.0000				
	FN+0					01R11	RES-4.64K 1% .12		0698-3155		M	+1.0000				
	FN+0					01R29,30	RES 14.7K 1%		0698-3156		M	+2.0000				
	FN+0					01R20	RES 19.6K		0698-3157		M	+1.0000				
	FN+0					01R16	RES-26.1K 1% .12		0698-3159		M	+1.0000				
	FN+0					01R13	RES-46.4K 1% .12		0698-3162		M	+1.0000				
	FN+0					01R18	RES-20.5K 1% .12		0698-3245		M	+1.0000				
	FN+0					01R62	RES 215 1% .125W		0698-3441		M	+1.0000				
	FN+0					01R8	RES 28.7K .125W		0698-3449		M	+1.0000				
	FN+0					01R43	RES-.22K 5% 2W		0698-3628		M	+1.0000				
	FN+0						RES 536 1% .125W		0698-4455 PART NO CONT		M	+2.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60146		3

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SPECIAL INSTRUCTIONS	FIX.	PT.	FEEDTHRU	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	D/C	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
						01R27,61	PART NO CONT		0698-4455							
	FN+0					01R38,49	RES 5K.1% .125W		0698-6320		M	+2.0000				
	FN+0					01R58	RES 9K .1% .125W		0698-6343		M	+1.0000				
	FN+0					01R57	RES-3K .1% .125W		0698-6348		M	+1.0000				
	FN+0					01R54	RES 109 .64K .1%		0698-7366		M	+1.0000				
	FN+0					01R53	RES 9M 1% .125W		0698-8137		M	+1.0000				
	FN+0					01R48	RESISTOR-FIXED		0698-8642		M	+1.0000				
	FN+0					01R40	RES 681K 1% .125		0698-8825		M	+1.0000				
	FN+0					01R42,52,55	RESISTOR 1M		0698-8827		M	+3.0000				
	FN+0					01R23	RES 3.16M 1%		0699-0070		M	+1.0000				
	FN+0					01R31	RES 4.64M 1%		0699-0071		M	+1.0000				
	FN+0					01R51	RES 10M 1% .125W		0699-0073		M	+1.0000				
	FN+0					01R50	RES 1M .1% .125W		0699-0730		M	+1.0000				
	FN+0					01R10	RES 1.96 .1%		0699-0847		M	+1.0000				
	FN+0					01R37	RES 47 .28K 1%		0699-2758		M	+1.0000				
	FN+0					05R2	8 ohm RES. 5% 5W		0699-2771		M	+1.0000				
	FN+0					01R7	RES-21.5K 1% .12		0757-0199		M	+1.0000				
	FN+0					01R21,32,41,56	RES-1K 1% .125W		0757-0280		M	+4.0000				
	FN+0						RES 1M 1% .25W		0757-0344 PART NO CONT		M	+2.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION: PCA BATTERY CHRG | EDE NUMBER | MODEL OR ASSEMBLY NUMBER: 43100-60146 | OPTION | PAGE 4*
DIV. 30 | PRD. SPECS. 008 | LT. P | PRIMARY MODEL | RELEASE DATE | REVISION DATE 91-04-04 | CYCLE 1144 | DELIVER TO

YIELD	DES. CODE	PT.	FEA. CODE	ITEM NO.	REFERENCE DESIGNATOR (FIRST ISS)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	QUANTITY PER	UM	POLICY / P ISSUE	ALTERNATE DELIVER TO
						PART NO CONT		0757-0344					
					01R1,6								
	FN+0					RES 1.62K 1% 1/8		0757-0428	M	+3.0000			
					01R47,63,64								
	FN+0					RES 6.81K 1%		0757-0439	M	+1.0000			
					01R36								
	FN+0					RES-10K 1% .125		0757-0442	M	+4.0000			
					01R22,25,28,45								
	FN+0					RES-51.1K 1% .12		0757-0458	M	+1.0000			
					01R39								
	FN+0					RES-100K 1% .125		0757-0465	M	+2.0000			
					01R17,19								
	FN+0					RES-121K 1% .125		0757-0467	M	+5.0000			
					01R33,34,35,46,59								
	FN+0					RES 2.2K 5% 3W		0767-0020	M	+1.0000			
					01R5								
	FN+0					RES .68 1% 1PW		0811-1002	M	+1.0000			
					01R12								
	FN+0					RES .1 5% .5W PW		0811-3605	M	+1.0000			
					01R60								
	FN+0					SUPPRESS-VOLTAGE		0837-0193	M	+1.0000			
					01CR33								
	FN+0					DIO-V SUPPR		0837-0344	M	+1.0000			
					01CR2								
	FN+0					THERMISTOR 25K		0837-0402	M	+1.0000			
					01RT1								
	FN+0					HEAT SINK		1205-0634	M	+1.0000			
					01ZZ5								
	FN+0					HEAT SINK		1205-0754	M	+2.0000			
					01ZZ1,2								
	FN+0					CONN-POST-TP-SKT		1251-3027	M	+2.0000			
					01P19,20								
	FN+0					CONN UTIL		1251-3659	M	+1.0000			
					01J23								
	FN+0					CONN-POST-3P1N		1251-6429	M	+1.0000			
					01J24								
	FN+0					CONN-POST-TP-HDR		1251-8106 PART NO CONT	M	+1.0000			

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION: PCA BATTERY CHRG | EDE NUMBER | MODEL OR ASSEMBLY NUMBER: 43100-60146 | OPTION | PAGE 5*
DIV. 30 | PRD. SPECS. 008 | LT. P | PRIMARY MODEL | RELEASE DATE | REVISION DATE 91-04-04 | CYCLE 1144 | DELIVER TO

YIELD	DES. CODE	PT.	FEA. CODE	ITEM NO.	REFERENCE DESIGNATOR (FIRST ISS)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	QUANTITY PER	UM	POLICY / P ISSUE	ALTERNATE DELIVER TO
					01J22	PART NO CONT		1251-8106					
	FN+0					CONNECTOR		1252-0302	M	+1.0000			
					01J21								
	FN+0					CABLE TIE		1400-1318	4	+1.0000			
					01ZZ4								
	FN+0					IC ULN2061M		1820-3512	M	+1.0000			
					01U6								
	FN+0					IC LM337LZ		1826-0994	M	+1.0000			
					01U8								
	FN+0					IC LM392		1826-1126	M	+1.0000			
					01U12								
	FN+0					ICCT1004CZ		1826-1167	M	+2.0000			
					01U11,13								
	FN+0					IC MC34060P		1826-1208	M	+1.0000			
					01U1								
	FN+0					IC SWTCHG REGLTR		1826-1256	M	+1.0000			
					01U7								
	FN+0					IC +8V LIN REG		1826-1257	M	+1.0000			
					01U9								
	FN+0					IC OP290GP		1826-1997	M	+1.0000			
					01U10								
	FN+0					XSTR-2N3906		1853-0036	M	+1.0000			
					01Q2								
	FN+0					TRS SI PNP		1853-0217	M	+1.0000			
					01Q4								
	FN+0					XSTR PNP SI DARL		1853-0412	M	+2.0000			
					01Q3,14								
	FN+0					XSTR PNP		1853-0510	M	+1.0000			
					01Q8								
	FN+0					XSTR NPN SI		1854-1028	M	+1.0000			
					01Q9								
	FN+0					XSTR-2N6027		1855-0314	M	+1.0000			
					01Q5								
	FN+0					MOSFET N-CHAN		1855-0510	M	+1.0000			
					01Q1								
	FN+0					MOSFET P-CHAN		1855-0550 PART NO CONT	M	+1.0000			

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION: PCA BATTERY CHRG | EDE NUMBER | MODEL OR ASSEMBLY NUMBER: 43100-60146 | OPTION | PAGE 6*
DIV. 30 | PRD. SPECS. 008 | LT. P | PRIMARY MODEL | RELEASE DATE | REVISION DATE 91-04-04 | CYCLE 1144 | DELIVER TO

YIELD	DES. CODE	PT.	FEA. CODE	ITEM NO.	REFERENCE DESIGNATOR (FIRST ISS)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	QUANTITY PER	UM	POLICY / P ISSUE	ALTERNATE DELIVER TO
					01Q11	PART NO CONT		1855-0550					
	FN+0					TRANS-MOSFET		1855-0641	M	+1.0000			
					01Q6								
	FN+0					TRANSISTOR		1855-0696	M	+3.0000			
					01Q10,13,15								
	FN+0					MOSFET P-CHAN		1855-0726	M	+1.0000			
					01Q12								
	FN+0					THYR-2N5060 SCR		1884-0074	M	+1.0000			
					01Q7								
	FN+0					DIO-SWITCHING		1901-0044	M	+10.0000			
					01CR8,9,10,12,13,19,10CR20/22,39								
	FN+0					DIO-SWITCHING		1901-0620	M	+5.0000			
					01CR23,34,35,36,37								
	FN+0					DIO-1N4937		1901-0831	M	+1.0000			
					01CR3								
	FN+0					DIODE, SCHOTTKY		1901-0937	M	+1.0000			
					01CR32								
	FN+0					DIO-1N4936		1901-1065	M	+6.0000			
					01CR16,17,18,25,27,38								
	FN+0					DIO-V-SUPPR		1901-1288	M	+1.0000			
					01CR29								
	FN+0					DIO-ZNR 16V 5%		1902-0783	M	+3.0000			
					01CR6,7,28								
	FN+0					DIO-2NR 120V 5%		1902-0931	M	+1.0000			
					01CR15								
	FN+0					DIO-ZNR 1N5370B		1902-0933	M	+1.0000			
					01CR4								
	FN+0					DIO-ZNR 5.6V 5%		1902-0952	M	+1.0000			
					01CR24								
	FN+0					DIO-ZNR 18V 5%		1902-0964	M	+3.0000			
					01CR14,30,31								
	FN+0					DIO-ZNR 30V 5%		1902-0969	M	+1.0000			
					01CR5								
	FN+0					DIO-ZNR IN4621		1902-0983	M	+1.0000			
					01CR11								

MATERIAL LIST

HEWLETT PACKARD

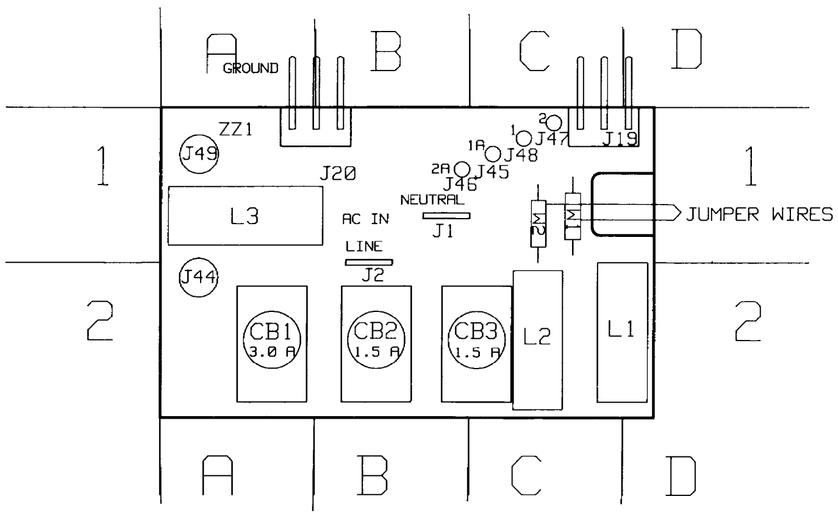
DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BATTERY CHRG		43100-60146		7 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	P		91-04-04	1144	

YIELD	SELECT	SUBSTITUTE GROUP	RT.	FD. I P	FORM	COMP	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
		PN+0					01	CR1	BRDG-DIO-600V		1906-0306		M	+1.0000			
		PN+0					01	CR26	DIODE		1906-0338		M	+1.0000			
		PN+0					01	U3	OPTO-ISOLATOR		1990-1074		M	+1.0000			
		PN+0					01	F4	FUSE, 1.6A, 250V		2110-0644		M	+1.0000			
		PN+0					01	FH1,FH2	FUSECLIP 5x20mm		2110-0689		M	+2.0000			
		PN+0					01	F1	FUSE 15A		2110-0697		M	+1.0000			
		PN+0					01	F2,3	FUSE 4A		2110-0712		M	+2.0000			
		PN+0	RN				01	ZZ6,ZZ7	SCR-MACH 6-32X.3		2360-0117		4	+2.0000		NBIN	
		PN+0					01	L2,3	CORE-FERRITE		9100-1788		M	+2.0000			
		PN+0					01	T1	XFMR-SWITCHING		9100-4484		M	+1.0000			
		PN+0					01	L6	INDUCTOR		9140-0983		M	+1.0000			
		PN+0					01	L1	INDUCTOR		9140-1029		M	+1.0000			
		PN+0					01	L5	INDUCTOR-FIXED		9140-1139		M	+1.0000			
		PN+0							CARRIER		9220-4576		M	+0.5000			
		PN+0							BAG-ANTI STATIC		9222-1367		M	+1.0000			
		YPN+0					01	P9	CBL-BATT TO PCB		43100-61624		4	+1.0000			
		PN+0					01	ZZ3	PCB-BATTERY CHG		43100-80145		M	+1.0000			
		PN+0					01	LBL1	BAR CODE LABEL		43100-84726		M	+1.0000			

END OF MATERIAL LIST

REF DESIG	GRID LOC	PART NUMBER
CB1	A2	3105-0193
CB2	B2	3105-0192
CB3	B2	3105-0192
J1	B1	1251-5613
J2	B2	1251-5613
J19	C1	1251-0599
J20	B1	1251-0599
J44	A2	0570-1318
J49	A1	0570-1318
L1	C2	9140-0251
L2	C2	9140-0251
L3	A1	9140-1046
W1	C1	8159-0005
W2	C1	8159-0005
ZZ1	A1	43100-80160



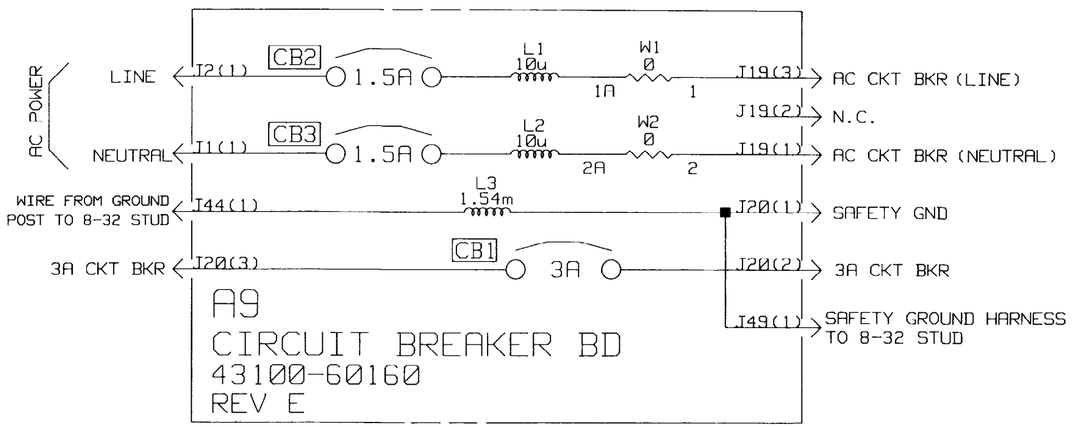


Figure 6-9. Schematic, Circuit Breaker Board.

MATERIAL LIST

HEWLETT PACKARD

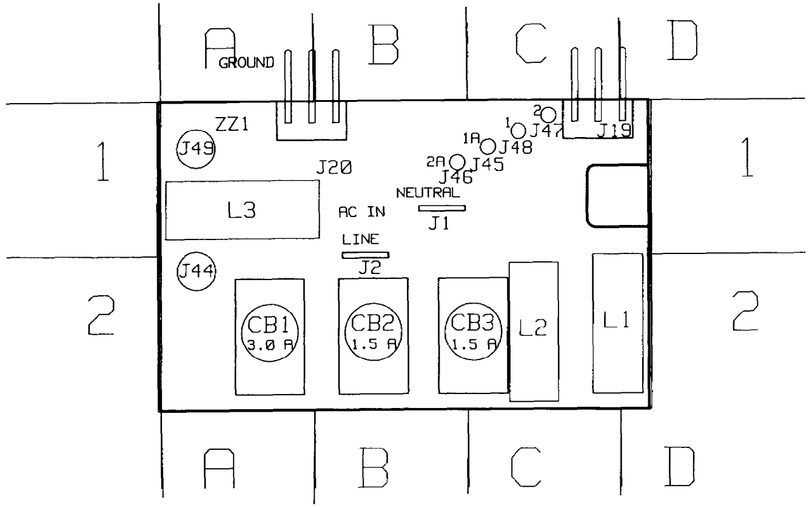
DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BREAKERS		43100-60160		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		005	F		85-06-05	5233	304820 0

YIELD	SUBSTITUTE	EXPLODE	RT.	FA. I	FA. P	FIRM	ITEM NO.	REFERENCE DESIGNATOR (FIRST 30)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	QTY. TYP.	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		PY	+0			N	01	J44,49	STUD-PRESS IN		0570-1318		4	+2.0000				
		PY	+0			N	01	J19,20	CONN-POST-TP-HDR		1251-0599		4	+2.0000				
		PY	+0			N	01	J45,46	CONN-SGL CONT		1251-5613		4	+2.0000				
		PY	+0			N	01	CB2,3	CKT BRKR 1.5 A		3105-0192		4	+2.0000				
		PY	+0			N	01	CB1	CKT BRKR 3.0 A		3105-0193		4	+1.0000				
		PY	+0			N	01	W1-3	RESISTOR- 0 OHM		8159-0005		4	+2.0000				
		PY	+0			N	01	L1,2	IDCTR 10UH 15%		9140-0251		4	+2.0000				
		PY	+0			N	01	L3	INDUCTOR		9140-1046		4	+1.0000				
		PY	+0			N			PCB-CKT BKR		43100-80160		4	+1.0000				

END OF MATERIAL LIST

REF DESIG	GRID LOC	PART NUMBER
CB1	A2	3105-0193
CB2	B2	3105-0192
CB3	B2	3105-0192
J1	B1	1251-5613
J2	B2	1251-5613
J19	C1	1251-0599
J20	B1	1251-0599
J44	A2	0570-1318
J49	A1	0570-1318
L1	F2	9140-0251
L2	E2	9140-0251
L3	A2	9140-1046
ZZ1	D1	43100-80160



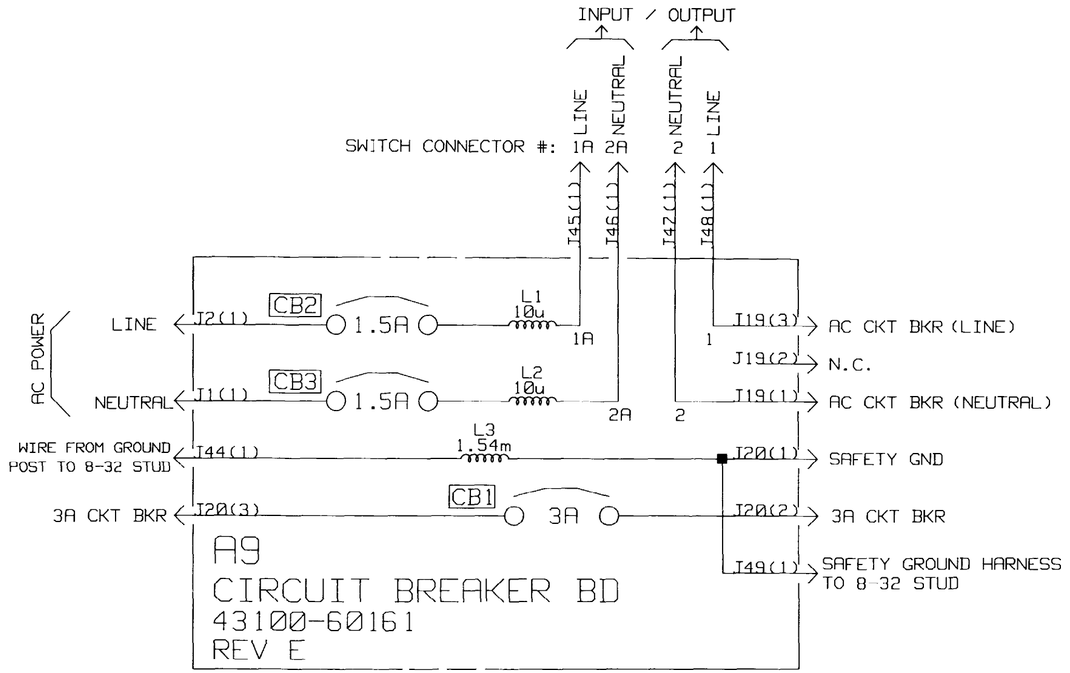


Figure 6-10. Schematic, Circuit Breaker Board.

MATERIAL LIST

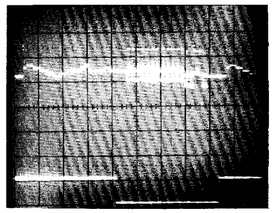
HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PCA BREAKERS		43100-60161		1 OF

DIV.	MFG. SPEC.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	F	85-06-19	85-10-07	5411	304820 0

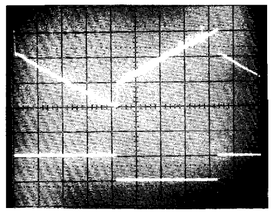
YIELD	TYPE	RT.	FD.	PHANTOM	ITEM NO.	REFERENCE DESIGNATOR (FIRST SMT)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
	PY+0	N		N		01J44,49	STUD-PRESS IN		0570-1318		4 +2.0000			
	PY+0	N		N		01J19,20	CONN-POST-TP-HDR		1251-0599		4 +2.0000			
	PY+0	N		N		01J45,46	CONN-SGL CONT		1251-5613		4 +2.0000			
	PY+0	N		N		01CB2,3	CKT BRKR 1.5 A		3105-0192		4 +2.0000			
	PY+0	N		N		01CB1	CKT BRKR 3.0 A		3105-0193		4 +1.0000			
	PY+0	N		N		01W1,2	RESISTOR- 0 OHM		8159-0005		4 +2.0000			
	PY+0	N		N		01L1,2	IDCTR 10UH 15%		9140-0251		4 +2.0000			
	PY+0	N		N		01L3	INDUCTOR		9140-1046		4 +1.0000			
	PY+0	N		N			PCB-CKT BKR		43100-80160		4 +1.0000			
	PY+0	N		N			LABEL, INFO		43100-84590		4 +1.0000			

END OF MATERIAL LIST



Q5-E IN SERVICE MODE 5V/DIV 2mS/DIV
VERTICAL
YOKE VOLTAGE

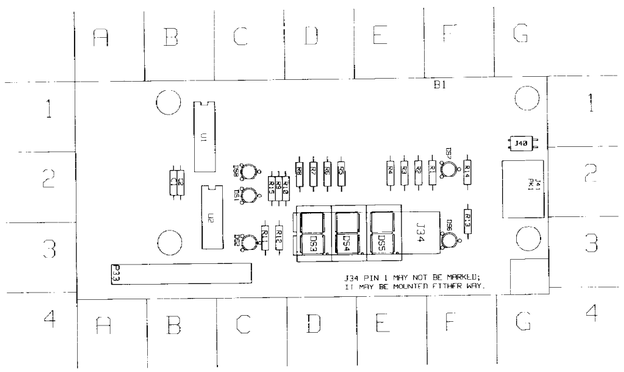
P31-3 5V/DIV
HORIZONTAL

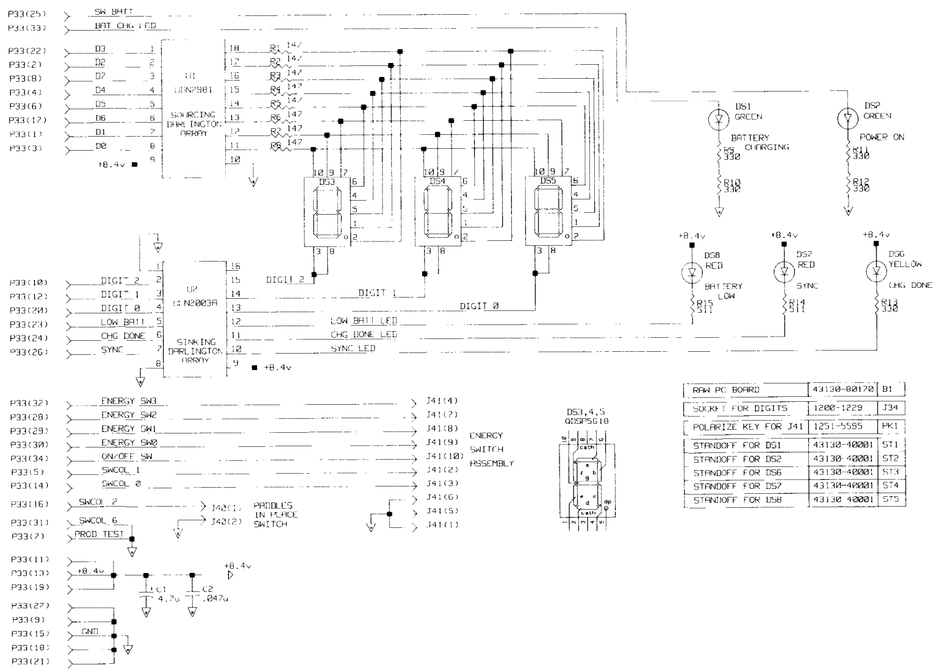


Q1-E IN SERVICE MODE 2V/DIV 2mS/DIV
HORIZONTAL
YOKE VOLTAGE

P31-3 5V/DIV
HORIZONTAL

REF DESIG.	GRID LOC.	PART NUMBER
B1	F1	43130-80170
C1	B2	0180-3552
C2	B2	0160-5422
DS1	C2	1990-0854
DS2	C3	1990-0854
DS3	D3	1990-1107
DS4	D3	1990-1107
DS5	E3	1990 1107
DS6	F3	1990-0848
DS7	F1	1990-0847
DS8	C2	1990-0847
J34	E3	1200-1229
J40	G1	1252-0263
J41	G2	1251-8671
P33	A3	43130-61605
PK1	G2	1251-5595
R1	F2	0698-3438
R2	E2	0698-3438
R3	F2	0698-3438
R4	E2	0698-3438
R5	D2	0698-3438
R6	D2	0698-3438
R7	D2	0698-3438
R8	D2	0698-3438
R9	C2	0683-3315
R10	C2	0683-3315
R11	C3	0683-3315
R12	C3	0683-3315
R13	F2	0683-3315
R14	F2	0757-0416
R15	C2	0757-0416
U1	B1	1820-2273
U2	B2	1858-0047
5 EA. LED STANDOFFS		43130-40001





RAW PC BOARD	43130-80170	B1
SOCKET FOR DIGITS	1200-1229	J34
POLARIZE KEY FOR J41	1251-5595	PK1
STANDOFF FOR DS1	43130-40001	ST1
STANDOFF FOR DS2	43130-40001	ST2
STANDOFF FOR DS6	43130-40001	ST3
STANDOFF FOR DS7	43130-40001	ST4
STANDOFF FOR DS8	43130-40001	ST5

Figure 6-11. Schematic, Display Board.

MATERIAL LIST

HEWLETT PACKARD

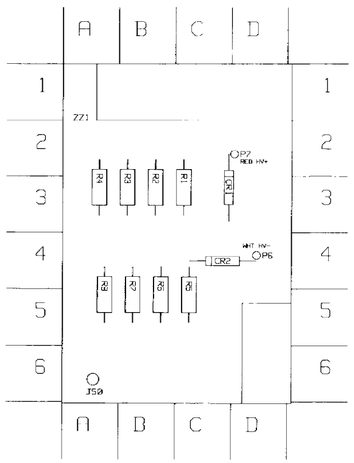
DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-DISPLAY BD		43130-60170		1 OF

DIV.	MFG. SPECL	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		005	F		85-10-18	5425	304820 0

YIELD	SUBSTITUTE	PHANTOM	RT.	FD.	REPORT	ITEM NO.	REFERENCE DESIGNATOR (FIRST 500)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	U/M	QUANTITY PER	U/M	POLICY	ALTERNATE DELIVER TO
		PY+0				01	C2	CAP .047UF 20%		0160-5422		4	+1.0000			
		PY+0				01	C1	CAP-FIXED 4.7UF		0180-3552		4	+1.0000			
		PY+0				01	R9-13	RES-.33K 5% .25W		0683-3315		4	+5.0000			
		PY+0				01	R1-8	RES 147 1% .125W		0698-3438		4	+8.0000			
		PY+0				01	R14,15	RES-.511K 1% .12		0757-0416		4	+2.0000			
		PY+0				01	J34	SOCKET-IC		1200-1229		4	+1.0000			
		PY+0				01	PK1	CONN-POST-TP-BDY		1251-5595		4	+1.0000			
		PY+0				01	J41	CONN-POST-TP-HDR		1251-8671		4	+1.0000			
		PY+0				01	J40	CONN-POST-TP-HDR		1252-0263		4	+1.0000			
		PY+0				01	U1	IC UDN2981A		1820-2273		4	+1.0000			
		PY+0				01	U2	XSTR ARY 16P-D1P		1858-0047		4	+1.0000			
		PY+0				01	DS7,8	LED-LMP RED		1990-0847		M	+2.0000			
		PY+0				01	DS6	LED-LMP YELLOW		1990-0848		M	+1.0000			
		PY+0				01	DS1,2	LED-GREEN		1990-0854		M	+2.0000			
		PY+0				01	DS3,4,5	LED-DISPLAY		1990-1107		4	+3.0000			
		PY+0				01	ST1-5	STANDOFF-LED		43130-40001		4	+5.0000			
		PY+0				01	P33	CBL AY-DISPLAY		43130-61605		4	+1.0000			
		PY+0				01	B1	PCB-DISPLAY		43130-80170		4	+1.0000			

END OF MATERIAL LIST

REF DESIG	GRID LOC	PART NUMBER
CR1	C3	T95192
CR2	C4	T95192
J50	A6	0570-1318
P6	D4	43130-61603
P7	D2	43130-61602
R1	C2	0699-0677
R2	B2	0699-0677
R3	B2	0699-0677
R4	A2	0699-0677
R5	C4	0699-0677
R6	B4	0699-0677
R7	B4	0699-0677
R8	A4	0699-0677
ZZ1	A2	43130-80210



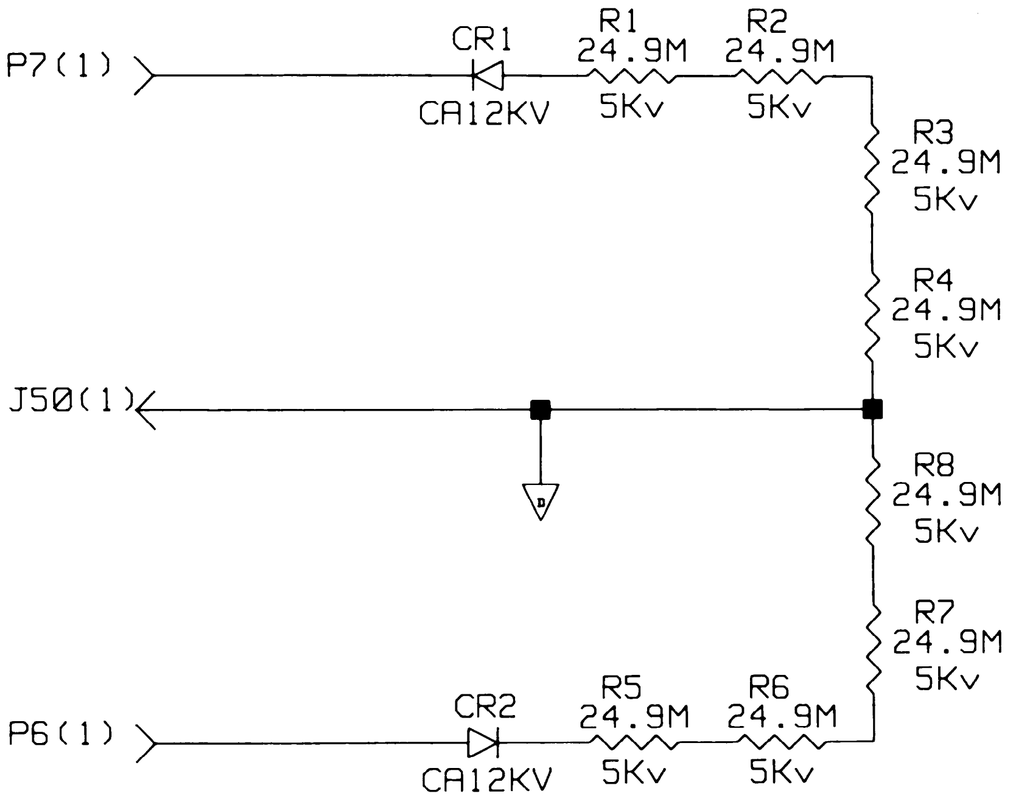


Figure 6-12. Schematic, Protection Board.

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDC NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PC AY-PROTCT CRC		43130-60210		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		180	F	85-10-29	85-10-30	5443	

YIELD	ASSY PURP	PHANTOM	RT.	FD.	FEDN NF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIG)	PART DESCRIPTION	CURRENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY	ALTERNATE DELIVER TO
	PY	+0				01	J50	STUD-PRESS IN		0570-1318		4	+1.0000			
	PY	+0				01	R1-8	RESISTOR-HV		0699-0677		4	+8.0000			
	PY	+0				01	CR1,2	DIODE-HV RECT		1901-1197		M	+2.0000			
	YPY	+0				01	P7	CBL AY-RED HV		43130-61602		M	+1.0000			
	YPY	+0				01	P6	CBL AY-WHITE HV		43130-61603		M	+1.0000			
	PY	+0				01	ZZ1	PC BD-PDLS PROT		43130-80210		M	+1.0000			

END OF MATERIAL LIST

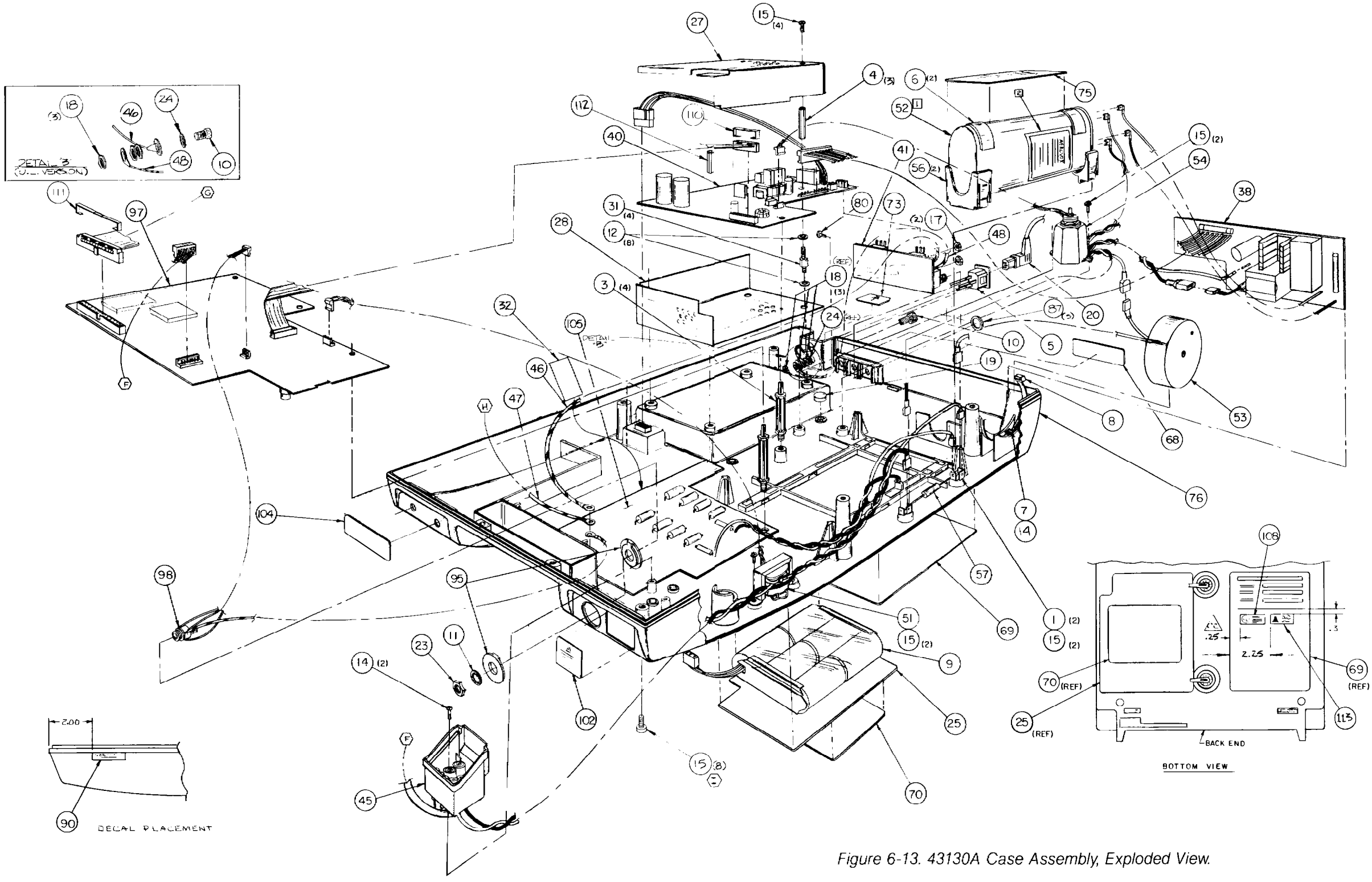


Figure 6-13. 43130A Case Assembly, Exploded View.

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DEFIB		43130A		1

DAY	SPEC	L.T.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30	007	I		89-03-20	91-04-08	1151	304800 0

YIELD	TYPE	BOM	MFG	PT.	FD.	I	P	D	N	P	ITEM NO.	REFERENCE DESIGNATOR (FIRST SHT)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	D C	QUANTITY PER	UM	POLICY P	ISSUE	ALTERNATE DELIVER TO
		FY	+	C			N						TERMINAL		0360-2233		4	+2.0000				
		FY	+	C			N						STANDOFF		0380-1745		4	+4.0000				
		FY	+	C			N						STDF-HEX .375-IN		0380-1752		4	+4.0000				
		FY	+	C			N						STANDOFF-HEX ALM		0380-1801		4	+3.0000				
		FY	+	C			N						STANDOFF-HEX		0380-2006		4	+1.0000				
		FY	+	C									TAPE-INDL .5IN		0460-0677		M	+0.0000				
		FY	+	C	B	N	N						TAPE-POLY .0065		0460-0928		4	+0.0000	RL	NBIN		
		FY	+	C									TAPE-.188 WIDE		0460-2007		4	+0.0000	RL			
		FY	+	C	B	N	N						ADH-RTV3145 CLR		0470-0450		4	+0.0000	TB	NBIN		
		FY	+	C									NUT-4-40 W/LKWR		0590-0199		P	+1.0000				
		FY	+	C			N						RETN-CLIP 20 PIN		1252-2218		4	+1.0000				
		FY	+	C			N						RETN-CLIP 34 PIN		1252-2220		4	+1.0000				
		FY	+	C			N						MOUNT-CBL TIE		1400-1100		4	+1.0000				
		FY	+	C			N						CABLE TIE		1400-1318		4	+4.0000				
		FY	+	C			N						BATTERY ASSY		1420-0339		4	+1.0000				
		FY	+	C			N						BINDING POST-SGL		1510-0038		4	+1.0000				
		FY	+	C			N						INT LW 3/8		2190-0016		4	+1.0000				
		FY	+	C	B	N	N						INT LW #6		2190-0065		4	+8.0000		NBIN		
		FY	+	C			N						PHMS 4-40X.375		2200-0107		4	+3.0000				
		FY	+	C			N						SCRW 4-40 X 1/4		2200-0165		4	+1.0000				
		FY	+	C	B	N	N						SCR-MACH 6-32X.3		2360-0117		4	+24.0000		NBIN		
		FY	+	C			N						PHMS-6-32X.5 P		2360-0121		4	+4.0000				
		FY	+	C	N	N	N						NUT-HX LK WSHR		2420-0006		P	+4.0000		NBIN		
		FY	+	C			N						NUT-W/LKWSR 8-32		2580-0017		4	+3.0000				
		FY	+	C			N						NUT-HX 3/8-32		2950-0001		4	+1.0000				
		FY	+	C			N						NUT-HEX 1/4-32		2950-0071		4	+4.0000				
		FY	+	C			N						NUT		2950-0206		4	+3.0000				
		FY	+	C			N						PVC CAP, MOLDED		4040-2222		4	+1.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DEFIB		43130A		2

DAY	SPEC	L.T.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30	007	I		89-03-20	91-04-08	1151	304800 0

YIELD	TYPE	BOM	MFG	PT.	FD.	I	P	D	N	P	ITEM NO.	REFERENCE DESIGNATOR (FIRST SHT)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	D C	QUANTITY PER	UM	POLICY P	ISSUE	ALTERNATE DELIVER TO
		FY	+	C			N						PLUG-HOLE .125-D		6960-0126		4	+1.0000				
		FY	+	C		N							DECAL,UL		7120-7599		4	+1.0000		N		
		FY	+	C									SOLDER WIRE .032		8090-0098		M	+0.0000	LB			
		FY	+	C									SOLDER WIRE		8090-0346		M	+0.0000	LB			
		FY	+	C			N						CBL-AY-PWR CORD		8120-5213		9	+1.0000				
		FY	-	7			N						CTN-CORRUGATED		9211-5151		9	+1.0000				
		FY	+	C	R	N							COVER-PLASTIC		9222-0552		M	+1.0000		NREQ		
		FY	+	C	B	N	N						LBL-LINE PRINTER		9320-5632		M	+1.0000		NBIN		
		FY	+	C			N						WARRANTY STMNT		5953-6726		9	+1.0000				
		FY	+	C			N						OP CARD-43130A		5953-9947		9	+1.0000				
		FY	+	C			N						GUTS PROCEDURE		5953-9964		9	+1.0000				
		FY	+	C		Y	N						INSTRUCTION SHT		5955-7858		9	+1.0000	SH	Y		
		FY	+	C									GASKET-THICK		43100-06700		4	+1.0000				
		FY	+	C			N						BATTERY DOOR		43100-07300		4	+1.0000				
		FY	+	C			N						SUPPORT-SW PNL		43100-07309		4	+1.0000				
		FY	+	C			N						SHIELD-TOP		43100-07321		4	+1.0000				
		FY	+	C			N						SHIELD-BTM		43100-07322		4	+1.0000				
		FY	+	C									PAD-MTG		43100-07326		4	+3.0000				
		FY	+	C			N						STANDOFF		43100-27313		4	+4.0000				
		FY	+	C			N						RECORDER LID		43100-40033		4	+1.0000				
		FY	+	C			N						CONNECTOR LATCH		43100-40038		4	+1.0000				
		FY	+	C			N						LATCH COVER		43100-40039		4	+1.0000				
		FY	+	C									AERO CAP-CRADLE		43100-47300		4	+2.0000				
	Y	FY	+	C			N						PC AY-HV CHGR		43100-60120		4	+1.0000				
	Y	FY	+	C									PCA BATTERY CHRG		43100-60145		4	+1.0000				
	Y	FY	+	C			N						PCA BREAKERS		43100-60160		4	+1.0000				
	Y	FY	+	C			N						PDL SET W/O PCI		43100-60406		4	+1.0000				
		FY	+	C			N						CBL ASSY PD CONN		43100-61611		4	+1.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DEFIB		43130A		3

DAY	SPEC	L.T.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30	007	I		89-03-20	91-04-08	1151	304800 0

YIELD	TYPE	BOM	MFG	PT.	FD.	I	P	D	N	P	ITEM NO.	REFERENCE DESIGNATOR (FIRST SHT)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	D C	QUANTITY PER	UM	POLICY P	ISSUE	ALTERNATE DELIVER TO
	Y	FY	+	C			N						CBL AY-GROUND		43100-61620		4	+1.0000				
	Y	FY	+	C			N						XFMR PUSH-PULL		43100-62701		4	+1.0000				
	Y	FY	+	C									AEROVOX CAP ASSY		43100-62803		4	+1.0000				
		FY	+	C									INDUCTOR		43100-62815		4	+1.0000				
	Y	FY	+	C			N						RESISTOR ASSY		43100-67105		4	+1.0000				
	Y	FY	+	C			N						PATIENT LOAD AY		43100-67115		4	+1.0000				
		FY	+	C									H.V. RELAY		43100-82821		4	+1.0000				
		FY	+	C									LABEL WARN, CSA		43100-84520		4	+1.0000				
		FY	+	C									LBL-CAUTION AC		43100-84577		4	+1.0000				
		FY	+	C			N						BATTERY CONN LBL		43100-84618		4	+1.0000				
		FY	+	C			N						LABEL		43100-84641		M	+1.0000				
		FY	+	C			N						CASE AY-LWR		43100-87106		4	+1.0000				
		FY	+	C			N						CASE AY-UPPER		43100-87116		4	+1.0000				
		FY	-	5			N						PAD-SHIPING FOAM		43100-87803		9	+1.0000	ST			
	Y	FY	+	C									CBL AY-PWR CORD		43120-61604		4	+1.0000		N		
		FY	+	C			N						WASHER		78620-00849		4	+1.0000				
		FY	+	C			N						BRACKET		43130-07300		4	+1.0000				
		FY	+	C			N						PANEL		43130-07301		4	+1.0000				
		FY	+	C			N						SPACER		43130-27300		4	+1.0000				
		FY	+	C			N						SUPPORT-DISPLAY		43130-27301		4	+1.0000				
		FY	+	C			N						LED REFLECTOR		43130-27302		4	+5.0000				
		FY	+	C			N						ADAPTER-CONN		43130-40000		4	+2.0000				
	Y	FY	+	C			N						PC AY-DISPLAY BD		43130-60170		4	+1.0000				
	Y	FY	+	C			N						PC AY-CNTL BRD		43130-60200		4	+1.0000				
	Y	FY	+	C			N						PC AY-PROTCT CRC		43130-60210		4	+1.0000				
		FY	+	C			N						CBL-MONITOR INTF		43130-61601		4	+1.0000				
	Y	FY	+	C			N						CBL AY-SFTY GND		43130-61604		4	+1.0000				
	Y	FY	+	C									CABLE ASSY		43130-61606		4	+1.0000				

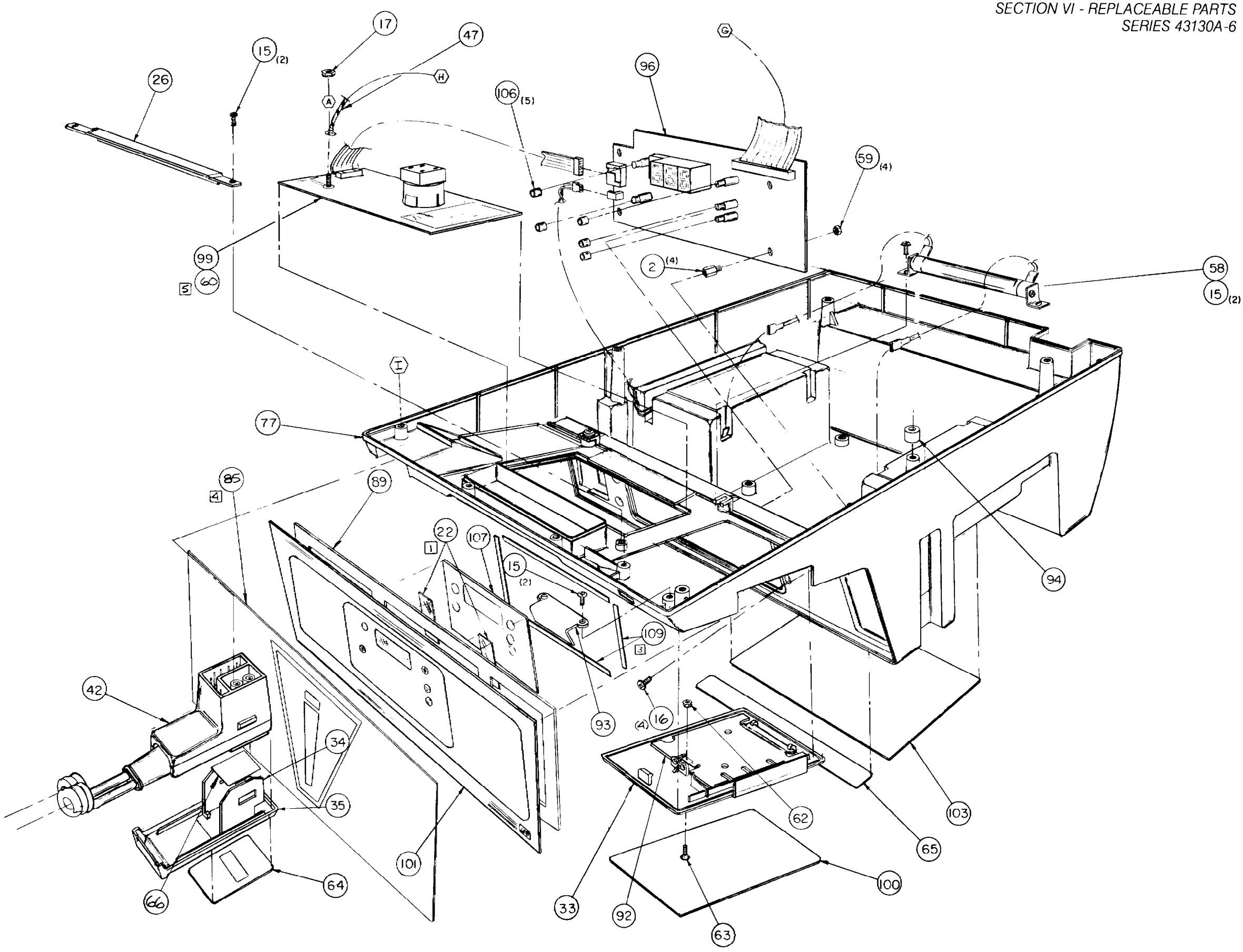


Figure 6-14. 43130A Case Assembly, Exploded View, (Cont.)

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DEFIB		43130A		4 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE		REVISION DATE	CYCLE	DELIVER TO
30		007	I	89-03-20		91-04-08	1151	304800 0

YIELD	SPCL	EXPLD	PT.	FD. I/P	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P/I	ALTERNATE DELIVER TO
	Y	R	1+0		N			PANEL-ENERGY		43130-61900		4	+1.0000			
	Y	F	Y+0		N			KIT-ACCESSORY		43130-69501		9	+1.0000			
		F	Y+0		N			PNL-FRT LED ENGL		43130-84510		4	+1.0000			
		F	Y+0		N			LBL SET-43130A		43130-84680		4	+1.0000			
		F	Y+0		N			OP GUIDE		43130-91908		9	+1.0000			
	Y	I	Y+0					UK PWR CORD		43130A #900		9	+0.0000			
	Y	I	Y+0					AUST PWR CORD		43130A #901		9	+0.0000			
	Y	I	Y+0					EUR PWR CORD		43130A #902		9	+0.0000			
	Y	I	Y+0					SWISS PWR CORD		43130A #906		9	+0.0000			
	Y	I	Y+0					DANISH PWR CORD		43130A #912		9	+0.0000			
	Y	I	Y+0					S.AFRICA PWR CD		43130A #917		9	+0.0000			
	Y	I	Y+0					ADULT INT PDL		43130A #C02		M	+0.0000			
	Y	I	Y+0					A/P PADDLES		43130A #C03		9	+0.0000			
	Y	I	Y+0					ADULT INTERNAL		43130A #C04		9	+0.0000			
	Y	I	Y+0					PED INTERNAL		43130A #C05		9	+0.0000			
	Y	I	Y+0					INFANT INTERNAL		43130A #C06		9	+0.0000			
	Y	I	Y+0					SERVICE MANUAL		43130A #C07		9	+0.0000			
	Y	I	Y+0					DELETE A/A PDLS		43130A #C09		9	+0.0000			
	Y	I	Y+0					PDL SET-STERIL		43130A #C12		M	+0.0000			
	Y	I	Y+0					ACC POUCH KIT		43130A #K01		9	+0.0000			
	Y	I	Y+0					FRENCH LABELS		43130A #L01		9	+0.0000			
	Y	I	Y+0					GERMAN LABELS		43130A #L02		9	+0.0000			
	Y	I	Y+0					DUTCH LABELS		43130A #L03		9	+0.0000			
	Y	I	Y+0					SPANISH LABELS		43130A #L04		9	+0.0000			
	Y	I	Y+0					ITALIAN LABELS		43130A #L05		9	+0.0000			
	Y	I	Y+0					SWEDISH LABELS		43130A #L06		9	+0.0000			
	Y	I	Y+0					CSA APPROVAL		43130A #N01		9	+0.0000			
	Y	I	Y+0					IEC/VDE APPROVAL		43130A #N02		9	+0.0000			

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DEFIB		43130A		5 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE		REVISION DATE	CYCLE	DELIVER TO
30		007	I	89-03-20		91-04-08	1151	304800 0

YIELD	SPCL	EXPLD	PT.	FD. I/P	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P/I	ALTERNATE DELIVER TO
	Y	I	Y+0					WALL MNT HRDWARE		43130A #R01		9	+0.0000			
	Y	I	Y+0					TAPE-UMATIC		43130A #Y01		9	+0.0000			
	Y	I	Y+0					TAPE-VHS		43130A #Y02		9	+0.0000			
	Y	I	Y+0					TAPE-BETA		43130A #Y03		9	+0.0000			
	Y	I	Y+0					SVC TAPE-UMATIC		43130A #Y04		M	+0.0000			
	Y	I	Y+0					SVC TAPE-VHS		43130A #Y05		M	+0.0000			
	Y	I	Y+0					SVC TAPE-BETA		43130A #Y06		M	+0.0000			
	Y	I	Y+0					50Hz OPERATION		43130A #Z01		9	+0.0000			
	Y	I	Y+0					230V POWER		43130A #Z05		9	+0.0000			
	Y	F	Y+0					FIELD SPT PARTS		43130A-FS		M	+0.0000			

END OF MATERIAL LIST

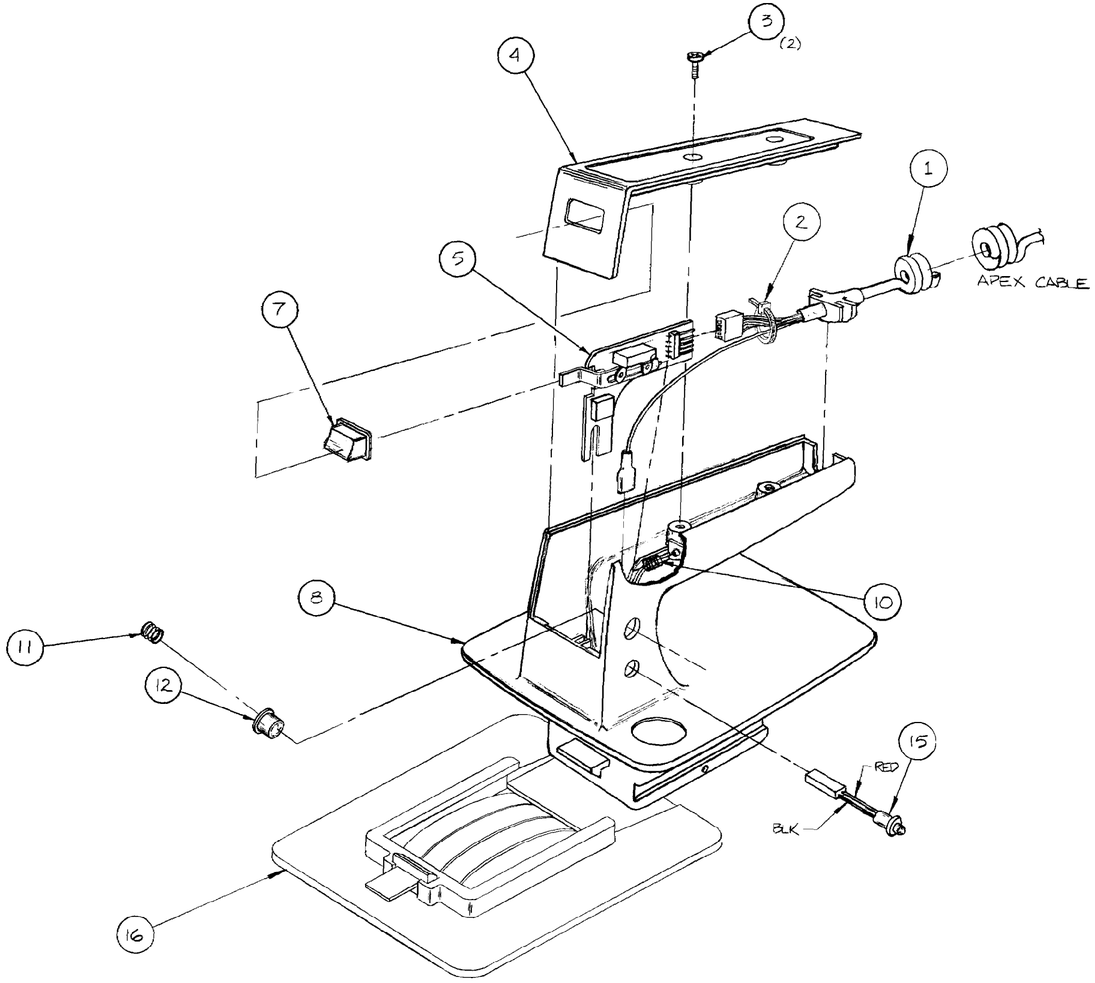


Figure 6-15. Sternum Paddle Assembly, Exploded View

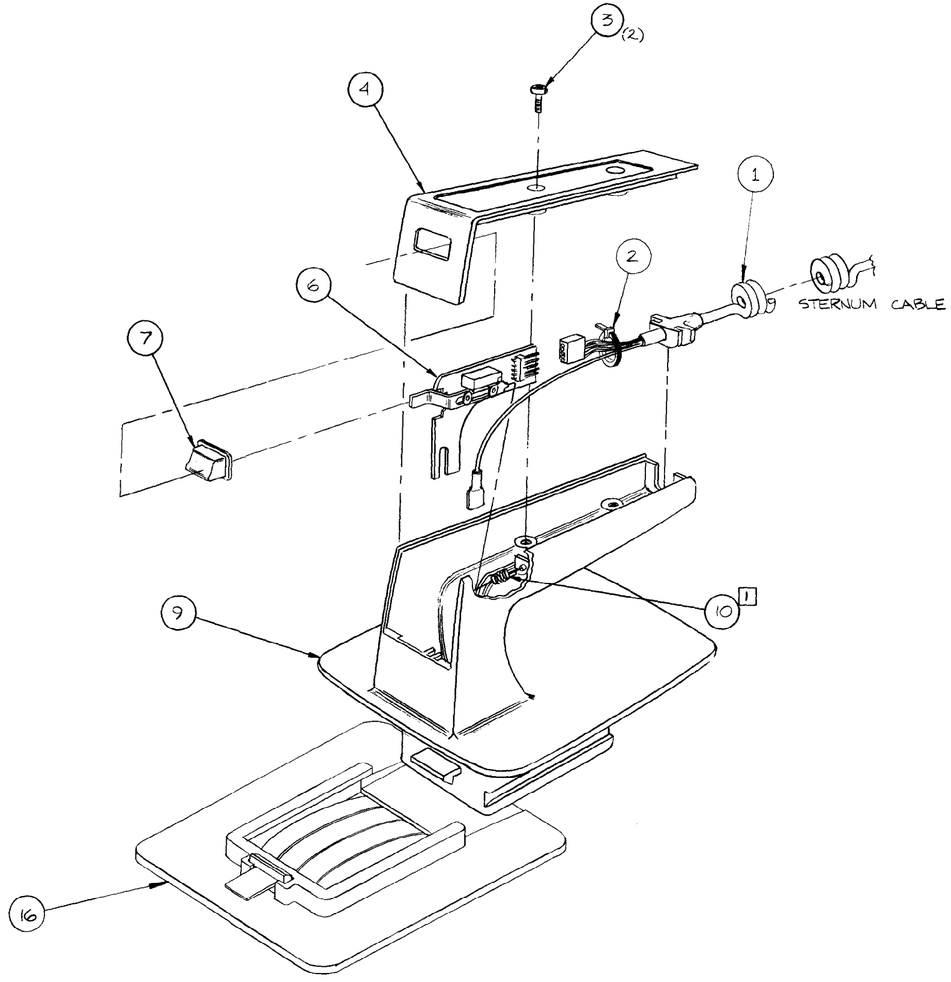


Figure 6-16. Apex Paddle Assembly, Exploded View.

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PDL SET W/O PCI		43100-60406		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30			F	85-05-15	89-03-10	9105	304800 0

YIELD	SELECT	PICK BELOW	PT.	FD. I P	FORM F	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
	FY	+0		RN			2	TIE WRAP		1400-0307		M	+2.0000		NBIN	
	FY	+0		N			3	PHMS 4-40X.375		2200-0107		4	+4.0000			
	FY	+0		N			8	PDL-APEX		43100-47114		4	+1.0000			
	FY	+0		N			4	COVER-PDL		43100-47118		4	+2.0000			
	FY	+0		N			12	BUTTON-CHG		43100-47120		4	+1.0000			
	FY	+0		N			7	BUTTN-DISCHARGE		43100-47121		4	+2.0000			
	FY	+0		N			9	PDL W/O DISPLAY		43100-47122		4	+1.0000			
	YFB	+0		N			5	PC AY PDL SWTCH		43100-60125		4	+1.0000			
	YFB	+0		N			6	PC AY-PDL SW		43100-60135		4	+1.0000			
	FY	+0		N			16	ADULT PDL ASSY		43100-60400		4	+2.0000			
	YFY	+0		N			1	PADDLE SET-CABLE		43100-61627		4	+1.0000			
	YFB	+0					15	PDL-LT ASSY		43100-63000		M	+1.0000			
	FY	+0		N			10	SPRING		43100-87400		4	+2.0000			
	FY	+0		N			11	SPRING		43100-87402		4	+1.0000			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PDL SET W/LBL		43100-60416		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		008	F	85-09-12	89-02-13	9071	304800 0

YIELD	SELECT	PICK BELOW	QTY.	FD. I P	FORM F	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
	FY	+0	RN					CARTON-CORR		9211-2634		M	+1.0000		NREQ	
	FB	+0						LBL SET-43110A		43110-84680		4	+1.0000	SH		
	FY	+0		N				CONNECTOR LATCH		43100-40038		4	+1.0000			
	FY	+0		N				LATCH COVER		43100-40039		4	+1.0000			
	YFB	+0						PDL SET W/O PCI		43100-60406		4	+1.0000			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
A/P PADDLES		43130A #C03		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		180	I		85-09-05	5364	

YIELD	SECT	PUBS	XPLD	RT.	FD. I	FD. P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	Y	Y	Y	+0							ANT-POST ELECT	C03	14412D		4	+1.0000				

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EOE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
ADULT INTERNAL		43130A #C04		1 OF

DIV.	MFG. SPECL	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		180	I		85-09-05	5364	

YIELD	SECT	PHAN	KPDS	RT.	FD. I	FD. P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	Y			+0							HANDLE SET-INT	C04	14990B		4	+1.0000				
		P	Y	+0							ELECT SET-ADULT	C04	14993A		M	+1.0000	ST			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
PED INTERNAL		43130A #C05		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		180	I		85-09-05	5364	

YIELD	SPCT	PUOM	SCRP	RT.	FD. I	FD. P	FORM	CONV	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	Y	F	Y	+0							HANDLE SET-INT	C	05140908		4	+1.0000				
		F	Y	+0							ELECT SET-PED	C	05140928		M	+1.0000	ST			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EOE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
INFANT INTERNAL		43130A #C06		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		180	I		85-09-05	5364	

YIELD	SECT	SUBS	EXCD	RT.	FD. I	FD. P	FORM	ECNO	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	Y			+0							HANDLE SET-INT		C0614990B		4	+1.0000				
	P			+0							ELCTD-INTL INFT		C0614994A		M	+1.0000	ST			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SERVICE MANUAL		43130A #C07		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		180	I		85-09-05	5364	

YIELD	SELECT	PUBLISH	XPLOD	RT.	FD. I	FD. P	FORM	ECN/F	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FY+0									SERVICE MANUAL	C07	43130-91909		M	+1.0000				

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DELETE A/A PDLS		43130A #C09		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		005	I		85-11-05	5452	

YIELD	USAGE	OPT. DESC.	RT.	FD. I P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	YES	B	+0		N				PDL SET W/O PCI		C0943100-60406		4	-1.0000				
		PY	+0		N				LABEL-LATCH/UN		C0943100-84502		4	-1.0000				
		PY	+0		N				LABEL-APEX		C0943100-84513		4	-1.0000				
		PY	+0		N				LABEL-STERNUM		C0943100-84514		4	-1.0000				
		PY	+0		N				LABEL-CHARGE 2		C0943100-84517		4	-1.0000				

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
ACC POUCH KIT		43130A #K01		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		180	I		85-09-05	5364	

YIELD	SECT	EVEL	KEY LOC	RT.	FD. I P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST 50)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
	Y			R	Y					KIT-SOFT POUCH	K01	43100-69500		M	+1.0000			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
FRENCH LABELS		43130A #L01		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-08-25	6351	304800 0

WELD	SELECT	FUSED	PT.	FD. I P	FORM	COMP	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	U/C	QUANTITY PER	UM	POLICY P	ISSUE	ALTERNATE DELIVER TO
		PY+0		N					REMARKS	L01	0000-0000		M	+0.0000		N		
							01		43130A #L01 CAN ONLY									
							02		BE PROVIDED WITH									
							03		43131A #N02									
							04		IF ORDERED W/O OPTION									
							05		205, SUB 43100-84526									
							06		FOR 43100-84526									
		PY+0		N					LABEL-LATCH/UN	L01	43100-84502		4	-1.0000				
		PY+0		N					LABEL-CAUTION	L01	43100-84503		4	-1.0000				
		PY+0		N					LABEL-LINE V	L01	43100-84507		4	-1.0000				
		PY+0		N					LABEL-IDENT	L01	43100-84509		4	-1.0000				
		PY+0		N					LABEL-BATT COMP	L01	43100-84510		4	-1.0000				
		PY+0		N					LABEL-APEX	L01	43100-84513		4	-1.0000				
		PY+0		N					LABEL-STERNUM	L01	43100-84514		4	-1.0000				
		PY+0		N					LABEL-CHARGE 2	L01	43100-84517		4	-1.0000				
		PY+0		N					LABEL-WARNING HV	L01	43100-84518		4	-1.0000				
		PY+0		N					LABEL-LATCH	L01	43100-84522		4	+1.0000				
		PY+0		N					LABEL-LINE VOLT	L01	43100-84526		4	+1.0000				
		PY+0		N					LABEL-IDENT	L01	43100-84527		4	+1.0000				
		PY+0		N					LABEL-BATT COMP	L01	43100-84528		4	+1.0000				
		PY+0		N					LABEL-APEX	L01	43100-84531		4	+1.0000				
		PY+0		N					LABEL-CHARGE "2"	L01	43100-84533		4	+1.0000				
		PY+0		N					LABEL-WARNING HV	L01	43100-84534		4	+1.0000				
	Y	PB+0		N					PANEL-ENERGY	L01	43130-61900		4	-1.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
FRENCH LABELS		43130A #L01		2 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-08-25	6351	304800 0

YIELD	SELECT	EXPLD	PT.	FD. I	FD. P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	Y	B	+0			N				PANEL-ENERGY	L01	43130-61901		4	+1.0000				
		Y	+0			N				LABEL-EMER DEFIB	L01	43130-84500		4	-1.0000				
		Y	+0			N				LABEL-EMER DEFIB	L01	43130-84501		4	+1.0000				
		Y	+0			N				PNL-FRT LED ENGL	L01	43130-84510		4	-1.0000				
		Y	+0			N				PNL-FRT LED FREN	L01	43130-84511		4	+1.0000				
		Y	+0			N				LABEL-ECG INPUT	L01	43130-84520		4	-1.0000				
		Y	+0			N				LABEL-ECG INPUT	L01	43130-84521		4	+1.0000				
		Y	+0			N				LBL-PDL PLACEMNT	L01	43130-84526		4	-1.0000				
		Y	+0			N				LBL-PDL PLACEMNT	L01	43130-84527		4	+1.0000				
		Y	+0			N				LBL-STERNUM	L01	43130-84533		4	+1.0000				
		Y	+0			N				CAUTION-DANGER R	L01	43130-84541		4	+1.0000				
		Y	+0							OP GUIDE	L01	43130-91908		6	-1.0000				
		Y	+0							OP GUIDE-FRENCH	L01	43130-91918		6	+1.0000				

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	SIZE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
GERMAN LABELS		43130A #L02		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-07-28	6311	304800 0

YIELD	SECT	PUBL	XPLD	QTY.	FD. I P	FORT	CONT	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PRESENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
		FY+0			N					REMARKS		0000-0000		M	+0.0000		N	
								01		43130A #L02 CAN ONLY			0000-0000					
								02		BE PROVIDED WITH			0000-0000					
								03		43130A #N02			0000-0000					
								04		IF ORDERED W/O OPT Z05			0000-0000					
								05		SUB 43100-84507 FOR			0000-0000					
								06		43100-84560			0000-0000					
		FY+0								LABEL-INFO		7121-4642		4	+1.0000			
		FY+0			N					LABEL-LATCH/UN		43100-84502		4	-1.0000			
		FY+0			N					LABEL-CAUTION		43100-84503		4	-1.0000			
		FY+0			N					LABEL-LINE V		43100-84507		4	-1.0000			
		FY+0			N					LABEL-IDENT		43100-84509		4	-1.0000			
		FY+0			N					LABEL-BATT COMP		43100-84510		4	-1.0000			
		FY+0			N					LABEL-APEX		43100-84513		4	-1.0000			
		FY+0			N					LABEL-STERNUM		43100-84514		4	-1.0000			
		FY+0			N					LABEL-CHARGE 2		43100-84517		4	-1.0000			
		FY+0			N					LABEL-WARNING HV		43100-84518		4	-1.0000			
		FY+0			N					LABEL-CHARGE "2"		43100-84552		4	+1.0000			
		FY+0			N					LABEL-LATCH/UNLA		43100-84556		4	+1.0000			
		FY+0			N					LABEL-CAUTION		43100-84557		4	+1.0000			
		FY+0			N					LABEL-LINE VOLT		43100-84560		4	+1.0000			
		FY+0			N					LABEL-IDENT		43100-84561		4	+1.0000			
		FY+0			N					LABEL-BATT COMP		43100-84562		4	+1.0000			
		FY+0								LABEL-APEX		43100-84565		4	+1.0000			

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
GERMAN LABELS		43130A #L02		2 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-07-28	6311	304800 0

YIELD	SPECIAL	PHANTOM	ET.	FTI	FORM	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	QTY	QUANTITY PER	UM	POLICY	ALTERNATE DELIVER TO
	Y	R	B+0		N			PANEL-ENERGY		43130-61900		4	-1.0000			
	Y	R	B+0		N			PANEL-ENERGY		43130-61903		4	+1.0000			
			FY+0		N			LABEL-EMER DEFIB		43130-84500		4	-1.0000			
			FY+0		N			LABEL-EMER DEFIB		43130-84503		4	+1.0000			
			FY+0		N			PNL-FRT LED ENGL		43130-84510		4	-1.0000			
			FY+0		N			PNL-FRT LED DUTC		43130-84513		4	+1.0000			
			FY+0		N			LABEL-ECG INPUT		43130-84520		4	-1.0000			
			FY+0		N			LABEL-ECG INPUT		43130-84522		4	+1.0000			
			FY+0		N			LBL-PDL PLACEMNT		43130-84526		4	-1.0000			
			FY+0		N			LBL-PDL PLACEMNT		43130-84528		4	+1.0000			
			FY+0		N			LBL-STERNUM		43130-84534		4	+1.0000			
			FY+0					LABEL-LINE VOLT		43130-84545		4	+1.0000			
			FY+0					OP GUIDE		43130-91908		6	-1.0000			
			FY+0					OP GUIDE-GERMAN		43130-91928		6	+1.0000			
			FY+0					LICENSE-GERMAN		43130-91995		6	+1.0000			

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DUTCH LABELS		43130A #L03		1 OF

DIV.	FPC. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-07-28	6311	304800 0

YIELD	SECT	SUP	EXP	PT.	FD. I P	FORM	ECN	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	PY	+0		N						REMARKS		0000-0000		M	+0.0000		N		
								01		43130A #L03 CAN ONLY		0000-0000							
								02		BE PROVIDED WITH		0000-0000							
								03		43130A #N02		0000-0000							
								04		IF ORDERED W/O OPT Z05		0000-0000							
								05		SUB 43100-84507 FOR		0000-0000							
								06		43100-84545		0000-0000							
	PY	+0		N						LABEL-LATCH/UN		43100-84502		4	-1.0000				
	PY	+0		N						LABEL-CAUTION		43100-84503		4	-1.0000				
	PY	+0		N						LABEL-LINE V		43100-84507		4	-1.0000				
	PY	+0		N						LABEL-IDENT		43100-84509		4	-1.0000				
	PY	+0		N						LABEL-BATT COMP		43100-84510		4	-1.0000				
	PY	+0		N						LABEL-APEX		43100-84513		4	-1.0000				
	PY	+0		N						LABEL-STERNUM		43100-84514		4	-1.0000				
	PY	+0		N						LABEL-CHARGE 2		43100-84517		4	-1.0000				
	PY	+0		N						LABEL-WARNING HV		43100-84518		4	-1.0000				
	PY	+0		N						LABEL-LATCH/UNLA		43100-84541		4	+1.0000				
	PY	+0		N						LABEL-CAUTION		43100-84542		4	+1.0000				
	PY	+0		N						LABEL-LINE VOLT		43100-84545		4	+1.0000				
	PY	+0		N						LABEL-IDENT		43100-84546		4	+1.0000				
	PY	+0		N						LABEL-BATT COMP		43100-84547		4	+1.0000				
	PY	+0		N						LABEL-APEX		43100-84550		4	+1.0000				
	PY	+0		N						LABEL-CHARGE "2"		43100-84552		4	+1.0000				
	PY	+0		N						LABEL-WARNING HV		43100-84553		4	+1.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DUTCH LABELS		43130A #L03		2 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-07-28	6311	304800 0

YIELD	SELECT	SUB	ET.	FD. I	FD. P	FORM	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		PY	+0			N			LABEL-WARNING HV		43100-84568		4	+1.0000				
		YP	B+0			N			PANEL-ENERGY		43130-61900		4	-1.0000				
		YP	B+0			N			PANEL-ENERGY		43130-61902		4	+1.0000				
		PY	+0			N			LABEL-EMER DEFIB		43130-84500		4	-1.0000				
		PY	+0			N			LABEL-EMER DEFIB		43130-84502		4	+1.0000				
		PY	+0			N			PNL-FRT LED ENGL		43130-84510		4	-1.0000				
		PY	+0			N			PNL-FRT LED GERM		43130-84512		4	+1.0000				
		PY	+0			N			LABEL-ECG INPUT		43130-84523		4	+1.0000				
		PY	+0			N			LBL-PDL PLACEMNT		43130-84526		4	-1.0000				
		PY	+0			N			LBL-PDL PLACEMNT		43130-84529		4	+1.0000				
		PY	+0			N			LBL-STERNUM		43130-84535		4	+1.0000				
		PY	+0						OP GUIDE		43130-91908		6	-1.0000				
		PY	+0						OP GUIDE-DUTCH		43130-91938		6	+1.0000				

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SPANISH LABELS		43130A #L04		1 OF

DIV.	PFD. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-07-28	6311	304800 0

YIELD	SELECT	PHANTOM	XPLODE	RT.	FD. I	FD. P	FORMAT	CONFIG	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FY+0		N							REMARKS		0000-0000		M	+0.0000		N		
									01		43130A #L04 CAN ONLY			0000-0000						
									02		BE PROVIDED WITH			0000-0000						
									03		43130A #N02			0000-0000						
									04		IF ORDERED W/O OPT Z05			0000-0000						
									05		SUB 43100-84507 FOR			0000-0000						
									06		43100-84605			0000-0000						
		FY+0		N							LABEL-LATCH/UN		43100-84502		4	-1.0000				
		FY+0		N							LABEL-CAUTION		43100-84503		4	-1.0000				
		FY+0		N							LABEL-LINE V		43100-84507		4	-1.0000				
		FY+0		N							LABEL-IDENT		43100-84509		4	-1.0000				
		FY+0		N							LABEL-BATT COMP		43100-84510		4	-1.0000				
		FY+0		N							LABEL-APEX		43100-84513		4	-1.0000				
		FY+0		N							LABEL-STERNUM		43100-84514		4	-1.0000				
		FY+0		N							LABEL-CHARGE 2		43100-84517		4	-1.0000				
		FY+0		N							LABEL-WARNING HV		43100-84518		4	-1.0000				
		FY+0		N							LBL-LATCH/UNLTCH		43100-84601		4	+1.0000				
		FY+0		N							LBL-CAUTION		43100-84602		4	+1.0000				
		FY+0		N							LBL-LINE VOLTAGE		43100-84605		4	+1.0000				
		FY+0		N							LBL-IDENTIF		43100-84606		4	+1.0000				
		FY+0		N							LBL-BATT COMPART		43100-84607		4	+1.0000				
		FY+0		N							LBL-APEX		43100-84610		4	+1.0000				
		FY+0		N							LBL-CHARGE "2"		43100-84612		4	+1.0000				
		FY+0		N							LBL-WARNING HV		43100-84613		4	+1.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SPANISH LABELS		43130A #L04		2

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-07-28	6311	304800 0

YIELD	SCRAP	REQD	PT.	FD. I P	FORM	CONF	ITEM INCL	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
	Y	R	B		N				PANEL-ENERGY		43130-61900		4	-1.0000				
	Y	R	B		N				PANEL-ENERGY		43130-61904		4	+1.0000				
		F	Y		N				LABEL-EMER DEFIB		43130-84500		4	-1.0000				
		F	Y		N				LABEL-EMER DEFIB		43130-84504		4	+1.0000				
		F	Y		N				PNL-FRT LED ENGL		43130-84510		4	-1.0000				
		F	Y		N				PNL-FRT LED SPAN		43130-84514		4	+1.0000				
		F	Y		N				LABEL-ECG INPUT		43130-84520		4	-1.0000				
		F	Y		N				LABEL-ECG INPUT		43130-84524		4	+1.0000				
		F	Y		N				LBL-PDL PLACEMNT		43130-84526		4	-1.0000				
		F	Y		N				LBL-PDL PLACEMNT		43130-84530		4	+1.0000				
		F	Y		N				LBL-STERNUM		43130-84536		4	+1.0000				
		F	Y						OP GUIDE		43130-91908		6	-1.0000				
		F	Y						OP GUIDE-SPANISH		43130-91948		6	+1.0000				

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
ITALIAN LABELS		43130A #L05		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-07-28	6311	304800 0

YIELD	SECT	SUPPLY	RT.	FD. I P	FORM	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	ISSUE	ALTERNATE DELIVER TO
		FY+0		N				REMARKS		0000-0000		M	+0.0000		N		
						01		43130A #L05 CAN ONLY			0000-0000						
						02		BE PROVIDED WITH			0000-0000						
						03		43130A #N02			0000-0000						
						04		IF ORDERED W/O OPT Z05			0000-0000						
						05		SUB 43100-84507 FOR			0000-0000						
						06		43100-84626			0000-0000						
		FY+0		N				LABEL-LATCH/UN		43100-84502		4	-1.0000				
		FY+0		N				LABEL-CAUTION		43100-84503		4	-1.0000				
		FY+0		N				LABEL-LINE V		43100-84507		4	-1.0000				
		FY+0		N				LABEL-IDENT		43100-84509		4	-1.0000				
		FY+0		N				LABEL-BATT COMP		43100-84510		4	-1.0000				
		FY+0		N				LABEL-APEX		43100-84513		4	-1.0000				
		FY+0		N				LABEL-STERNUM		43100-84514		4	-1.0000				
		FY+0		N				LABEL-CHARGE 2		43100-84517		4	-1.0000				
		FY+0		N				LABEL-WARNING HV		43100-84518		4	-1.0000				
		FY+0		N				LABEL-LATCH/UNLA		43100-84622		4	+1.0000				
		FY+0		N				LABEL-CAUTION		43100-84623		4	+1.0000				
		FY+0		N				LABEL-LINE VOLT		43100-84626		4	+1.0000				
		FY+0		N				LABEL-IDENT		43100-84627		4	+1.0000				
		FY+0		N				LABEL-BATT COMP		43100-84628		4	+1.0000				
		FY+0		N				LABEL-APEX		43100-84631		4	+1.0000				
		FY+0		N				LABEL-CHARGE "2"		43100-84633		4	+1.0000				
		FY+0		N				LABEL-WARNING HV		43100-84634		4	+1.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
ITALIAN LABELS		43130A #L05		2

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-23	86-09-04	6364	304800 0

YIELD	SELECT	PUBLD	XPLD	RT.	FD. I P	FORM	LOWER	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
	Y	R	B	+0						PANEL-ENERGY		43130-61900		4	-1.0000			
	Y	R	B	+0		N				PANEL-ENERGY		43130-61905		4	+1.0000			
		P	Y	+0		N				LABEL-EMER DEFIB		43130-84500		4	-1.0000			
		P	Y	+0		N				LABEL-EMER DEFIB		43130-84503		4	+1.0000			
		P	Y	+0		N				PNL-FRT LED ENGL		43130-84510		4	-1.0000			
		P	Y	+0		N				PNL-FRT LED ITAL		43130-84515		4	+1.0000			
		P	Y	+0		N				LABEL-ECG INPUT		43130-84520		4	-1.0000			
		P	Y	+0		N				LABEL-ECG INPUT	L05	43130-84525		4	+1.0000			
		P	Y	+0		N				LBL-PDL PLACEMNT	L05	43130-84526		4	-1.0000			
		P	Y	+0		N				LBL-PDL PLACEMNT	L05	43130-84531		4	+1.0000			
		P	Y	+0		N				LBL-STERNUM	L05	43130-84537		4	+1.0000			
		P	Y	+0						OP GUIDE	L05	43130-91908		6	-1.0000			
		P	Y	+0						OP GUIDE-ITALIAN	L05	43130-91958		6	+1.0000			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SWEDISH LABELS		43130A #L06		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-11-12	86-10-02	6404	304800 0

YIELD	SELECT	SUBSELECT	#1.	FD.	CODE	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	ISSUE	ALTERNATE DELIVER TO
		FY+0		N				REMARKS	L06	0000-0000		M	+0.0000		N		
								01CAN ONLY BE PROVIDED									
								02WITH 43130A #N02.									
								03IF ORDERED WITHOUT									
								0443130A #Z05 SUBST.									
								0543100-84507 FOR									
		FY+0						LABEL-LATCH/UN	L06	43100-84502		4	-1.0000				
		FY+0						LABEL-CAUTION	L06	43100-84503		4	-1.0000				
		FY+0						LABEL-LINE V	L06	43100-84507		4	-1.0000				
		FY+0						LABEL-IDENT	L06	43100-84509		4	-1.0000				
		FY+0						LABEL-BATT COMP	L06	43100-84510		4	-1.0000				
		FY+0						LABEL-APEX	L06	43100-84513		4	-1.0000				
		FY+0						LABEL-STERNUM	L06	43100-84514		4	-1.0000				
		FY+0						LABEL-CHARGE 2	L06	43100-84517		4	-1.0000				
		FY+0						LABEL-WARNING HV	L06	43100-84518		4	-1.0000				
		FY+0						LABEL-BATT COMP	L06	43100-84562		4	+1.0000				
		FY+0						LBL-LATCH/UNLTCH	L06	43100-84656		4	+1.0000				
		FY+0						LBL-CAUTION/DANG	L06	43100-84657		4	+1.0000				
		FY+0						LBL-LINE VOLTAGE	L06	43100-84660		4	+1.0000				
		FY+0						LBL-IDENT	L06	43100-84661		4	+1.0000				
		FY+0						LBL-CHARGE "2"	L06	43100-84663		4	+1.0000				
		FY+0						LBL-APEX	L06	43100-84665		4	+1.0000				
		FY+0						LBL-CHARGE "2"	L06	43100-84666		4	+1.0000				
		FY+0						LBL-WARNING, HV	L06	43100-84667		4	+1.0000				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SWEDISH LABELS		43130A #L06		2 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-11-12	86-10-02	6404	304800 0

YIELD	SELECT	SPLD	XPLD	PT.	FD. I	FD. P	FORM	LOWER	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PRNT OPTION	PART NUMBER	COMP OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FB	+0								LABEL-ON/OFF SWD	L06	43120-84536		4	+1.0000				
		YFB	+0								PANEL-ENERGY	L06	43130-61900		4	-1.0000				
		YFB	+0								SWITCH AY	L06	43130-61906		4	+1.0000				
		FY	+0								LABEL-EMER DEFIB	L06	43130-84500		4	-1.0000				
		FY	+0								LBL-EMERG DEFIB	L06	43130-84506		4	+1.0000				
		FY	+0								PNL-FRT LED ENGL	L06	43130-84510		4	-1.0000				
		FY	+0								PNL-FRT LED SWED	L06	43130-84516		4	+1.0000				
		FY	+0								LABEL-ECG INPUT	L06	43130-84520		4	-1.0000				
		FY	+0								LBL-PDL PLACEMNT	L06	43130-84526		4	-1.0000				
		FY	+0								LBL-ECG INPUT	L06	43130-84538		4	+1.0000				
		FY	+0								LBL-PDL PLACMNT	L06	43130-84539		4	+1.0000				
		FY	+0								LBL-STERNUM	L06	43130-84540		4	+1.0000				
		FY	+0								OP GUIDE	L06	43130-91908		M	-1.0000				
		FY	+0								OP GUIDE-SWEDISH	L06	43130-91968		M	+1.0000				

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
CSA APPROVAL		43130A #N01		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-08-29	86-09-30	6402	304800 0

YIELD	SELECT	SUBS	EXPLD	RT.	FD. I	FD. P	FORM	CONV	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FY	+0		N						REMARKS	N01	0000-0000		M	+0.0000		N		
									01		PARTS TO BE PACKAGED									
									02		AND SENT WITH UNIT									
		FY	+0		N						LABEL-CSA	N01	7120-6645		4	+1.0000				
		FY	+0	R	Y	N					LABEL-INFO	N01	7121-2526		4	+1.0000		Y	REQ	
		FY	+0	R	N						BAG-PLASTIC	N01	9222-0366		M	+1.0000		N	REQ	
		FY	+0		N						LABEL-CAUTION	N01	43100-84503		4	-1.0000				
		FY	+0		N						LBL-CAUTION	N01	43100-84504		4	+1.0000				
		FY	+0		N						LABEL-IDENT	N01	43100-84509		4	-1.0000				
		FY	+0		N						LABEL-WARN,CSA	N01	43100-84520		4	+1.0000				
		FY	+0								LABEL-LATCH	N01	43100-84522		4	+1.0000				
		FY	+0								LABEL-BATT COMP	N01	43100-84528		4	+1.0000				
		FY	+0								LABEL-EMER DEFIB	N01	43130-84501		4	+1.0000				
																END OF MATERIAL LIST				

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
IEC/VDE APPROVAL		43130A #N02		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		007	I	85-11-05	89-02-13	9071	304800 0

YIELD	SECT	PUBS	XPSD	RT.	FD. I	FD. P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		PY	+0			N					CONN-SGL CONT	N02	1251-5964		4	+1.0000				
		PY	+0			N					BINDING POST-SGL	N02	1510-0038		4	-1.0000				
		PY	+0		N						DECAL,UL	N02	7120-7599		4	-1.0000		N		
		PY	+0								WARRANTY STMNT	N02	5953-6726		M	-1.0000				
		PY	+0								GUTS PROCEDURE	N02	5953-9964		M	-1.0000				
	Y	PY	+0			N					PCA BREAKERS	N02	43100-60160		4	-1.0000				
	Y	PY	+0			N					PCA BREAKERS	N02	43100-60161		4	+1.0000				
	Y	RB	+0								CBL AY-LOW VOLT	N02	43100-61621		4	+1.0000				
		PY	+0								CASE AY-LWR	N02	43100-87106		4	-1.0000				
	Y	PY	+0			N					CASE AY-LWR MOD	N02	43120-87102		4	+1.0000				

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
WALL MNT HRDWARE		43130A #R01		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304041FG

YIELD	SECT	PUBS	XPLD	INT.	FD. I	FD. P	FORM	LOW	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PRESENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		PY	+0								HOLDER-WALL MTG		1400-1401		M	+1.0000				
		PY	+0								INST-WALL MT KIT		43100-91922		M	+1.0000				
											END OF OPTION LIST									

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
TAPE-UMATIC		43130A #Y01		1 OF

DIV.	MFG. SPECL	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304041FG

YIELD	SECT	PUBD	XPUBD	RT.	FD. I P	FORM	EDIT	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
		FY		+0						TAPE-UMATIC		43100-89000		M	+1.0000			

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
TAPE-VHS		43130A #Y02		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304041FG

WELD	SELECTS	PLUS OR	QTY.	FD. I P	FOR MFG	CONN	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEC)	PART DESCRIPTION	PREVNT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
	FY	+0							TAPE-VHS		43100-89001		M	+1.0000			

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
TAPE-BETA		43130A #Y03		1 OF 1

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304041FG

YIELD	SECT	PURCH KEY CD	RT.	FD. I	FD. P	FORM	CONT	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FY	+0							TAPE-BETA		43100-89002		M	+1.0000				

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SVC TAPE-UMATIC		43130A #Y04		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304041FG

YIELD	SELECT	PHANTOM	RT.	FD. I	FD. P	FORM	EDIT	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FY	+0							SVC TAPE-UMATIC		43100-89003		M	+1.0000				

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SVC TAPE-VHS		43130A #Y05		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304041FG

YIELD	SECT	SUBS	RT.	FD. I	FD. P	FORE	LOWR	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		PY	+0							SVC TAPE-VHS		43100-89004		M	+1.0000				

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SVC TAPE-BETA		43130A #Y06		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304041FG

YIELD	SECT	PUBS	XPLD	RT.	FD. I	FD. P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FY	+0								SVC TAPE-BETA		43100-89005		M	+1.0000				

END OF OPTION LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
50Hz OPERATION		43130A #Z01		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-10-31	86-07-28	6311	

YIELD	SELECT	PUBLISH	EFF.	FD. I P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PRESENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
	FY	+0	N						REMARKS		0000-0000		M	+0.0000		N	
							01		OPTION Z01 CAN ONLY BE			0000-0000					
							02		PROVIDED WITH			0000-0000					
							03		43130A #N02			0000-0000					
														END OF OPTION LIST			

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
100V POWER		43130A #Z02		1 OF

DIV.	PFL SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I	85-09-11	86-07-28	6311	304800 0

YIELD	SELECT	PURG	XPLD	PT.	FD. I P	FORM	CONT	ITEM NO.	REFERENCE DESIGNATOR (FIRST SET)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
		PY		+0	N					REMARKS		0000-0000		M	+0.0000		N	
								01		OPTION Z02 CAN ONLY BE			0000-0000					
								02		PROVIDED WITH			0000-0000					
								03		43130A #N02			0000-0000					
															END OF OPTION LIST			

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
230V POWER		43130A #Z05		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE		REVISION DATE	CYCLE	DELIVER TO
30		007	I	85-08-29		89-02-13	9071	304800 0

YIELD	SELECT	PUBS KPLD	RT.	FD. I P	FORM	CONF	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		PY	+0	N					REMARKS	Z05	0000-0000		M	+0.0000		N		
							01		OPTION Z05 CAN ONLY BE									
							02		PROVIDED WITH									
							03		43130A #N02									
		YF	Y+0		N				PCA BATTERY CHGR	Z05	43100-60140		4	-1.0000				
		YF	Y+0		N				PC AY-PWR SPLY	Z05	43100-60141		4	+1.0000				
		YF	B+0						CBL AY-LOW VOLT	Z05	43100-61621		4	-1.0000				
		YF	B+0						CBL AY-HIGH VOLT	Z05	43100-61641		M	+1.0000				

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
UK PWR CORD		43130A #900		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-09-29	6401	304800 0

YIELD	SELECT	PUBS	XPLD	RT.	FD. I P	FORM	CONFIG	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
		FY	+0			N				CBL-POWER CORD	900	8120-1703		4	+1.0000			
		FY	+0							CBL AY-PWR CORD	900	8120-4759		4	-1.0000			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
AUST PWR CORD		43130A #901		1 OF

DIV.	MFG. SPECIAL	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304800 0

YIELD	SECT	EXPLD	RT.	FD. I	FD. P	FORM	CONV	ITEM NO.	REFERENCE DESIGNATOR (FIRST SEG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	MOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FY	+0							CBL-POWER CORD		8120-4464		4	+1.0000				
		FY	+0							CBL AY-PWR CORD		8120-4759		4	-1.0000				
										END OF OPTION LIST									

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
EUR PWR CORD		43130A #902		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-08-25	6351	304800 0

YIELD	SCRAP	EFF VALID	RT.	FD. I P	FORM F	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIG)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
		FY+0			N			CBL-POWER CORD	902	8120-1692		4	+1.0000			
		FY+0						CBL AY-PWR CORD	902	8120-4759		4	-1.0000			

END OF MATERIAL LIST

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
SWISS PWR CORD		43130A #906		1 OF

DIV.	FPT. SPECL	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304800 0

YIELD	SPECIAL	EXPLODE	PT.	TD. I P	FORM	CODE	ITEM NO.	REFERENCE DESIGNATOR (FIRST SET)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
		PY	+0						CBL-POWER CORD		8120-2296		4	+1.0000			
		PY	+0						CBL AY-PWR CORD		8120-4759		4	-1.0000			
									END OF OPTION LIST								

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
DANISH PWR CORD		43130A #912		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304800 0

YIELD	SPECIAL	XPLOD	RT.	FD. I P	FORM	LOAD	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PARENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P ISSUE	ALTERNATE DELIVER TO
		FY	+0						CBL-POWER CORD		8120-2957		4	+1.0000			
		FY	+0						CBL AY-PWR CORD		8120-4759		4	-1.0000			
									END OF OPTION LIST								

MATERIAL LIST

HEWLETT PACKARD

DESCRIPTION	EDE NUMBER	MODEL OR ASSEMBLY NUMBER	OPTION	PAGE
S.AFRICA PWR CD		43130A #917		1 OF

DIV.	MFG. SPECS.	LT.	PRIMARY MODEL	RELEASE DATE	REVISION DATE	CYCLE	DELIVER TO
30		010	I		86-07-28	6311	304800 0

YIELD	SELECTS	XPLOD	RT.	FD. I P	FORMY	CONFY	ITEM NO.	REFERENCE DESIGNATOR (FIRST SIX)	PART DESCRIPTION	PRESENT OPTION	PART NUMBER	COMP. OPTION	LOC	QUANTITY PER	UM	POLICY P	POLICY ISSUE	ALTERNATE DELIVER TO
		FY+0							CBL-POWER CORD		8120-4600		4	+1.0000				
		FY+0							CBL AY-PWR CORD		8120-4759		4	-1.0000				
									END OF OPTION LIST									

	FRONT PANEL	ENERGY PNL	PDL PLCMT	EMERG INST	LATCH/UN	CAUTION	BEEP VOL	ECG INPT
43130A	43130-84510	43130-61900	43130-84526	43130-84500	43100-84502	43100-84503	43130-84590	43130-84520
43130A #C09	43130-84510	43130-61900	43130-84526	43130-84500		43100-84503	43130-84590	43130-84520
43130A #L01	43130-84511	43130-61901	43130-84527	43130-84501	43100-84522	43100-84523	43130-84590	43130-84521
43130A #L02	43130-84512	43130-61902	43130-84528	43130-84502	43100-84556	43100-84557	43130-84590	43130-84522
43130A #L03	43130-84513	43130-61903	43130-84529	43130-84503	43100-84541	43100-84542	43130-84590	43130-84523
43130A #L04	43130-84514	43130-61904	43130-84530	43130-84504	43100-84601	43100-84602	43130-84590	43130-84524
43130A #L05	43130-84515	43130-61905	43130-84531	43130-84505	43100-84622	43100-84623	43130-84590	43130-84525
43130A #L06	43130-84516	43130-61906	43130-84539	43130-84506	43100-84656	43100-84657	43130-84590	43130-84538
43130A #N01	43130-84510	43130-61900	43130-84526	43130-84500	43100-84502	43100-84504	43130-84590	43130-84520
43130A #N02	43130-84510	43130-61900	43130-84526	43130-84500	43100-84502	43100-84503	43130-84590	43130-84520
43130A #N05	43130-84510	43130-61900	43130-84526	43130-84500	43100-84502	43100-84503	43130-84590	43130-84520
43130A #Z01	43130-84510	43130-61900	43130-84526	43130-84500	43100-84502	43100-84503	43130-84590	43130-84520
43130A #Z02	43130-84510	43130-61900	43130-84526	43130-84500	43100-84502	43100-84503	43130-84590	43130-84520
43130A #Z05	43130-84510	43130-61900	43130-84526	43130-84500	43100-84502	43100-84503	43130-84590	43130-84520

	LINE V	IDENT	BATTCOMP	STERN	APEX	GND	CHG 2	WARNING HV
43130A	43100-84507	43100-84509	43100-84510	43100-84514	43100-84513	43100-84515	43100-84517	43100-84518
43130A #C09	43100-84507	43100-84509	43100-84510			43100-84515		43100-84518
43130A #L01	43100-84526	43100-84527	43100-84528	43130-84533	43100-84531	43100-84516	43100-84533	43100-84534
43130A #L02	43100-84560	43100-84561	43100-84562	43130-84534	43100-84565	43100-84516	43100-84552	43100-84568
43130A #L03	43100-84545	43100-84546	43100-84547	43130-84535	43100-84550	43100-84516	43100-84552	43100-84553
43130A #L04	43100-84605	43100-84606	43100-84607	43130-84536	43100-84610	43100-84516	43100-84612	43100-84613
43130A #L05	43100-84626	43100-84627	43100-84628	43130-84537	43100-84631	43100-84516	43100-84633	43100-84634
43130A #L06	43100-84660	43100-84661	43100-84662	43130-84540	43100-84665	43100-84516	43100-84666	43100-84667
43130A #N01	43100-84507	43100-84520	43100-84510	43100-84514	43100-84513	43100-84515	43100-84517	43100-84518
43130A #N02	43100-84507	43100-84509	43100-84510	43100-84514	43100-84513	43100-84516	43100-84517	43100-84518
43130A #N05	43100-84508	43100-84509	43100-84510	43100-84514	43100-84513	43100-84516	43100-84517	43100-84518
43130A #Z01	43100-84508	43100-84509	43100-84510	43100-84514	43100-84513	43100-84516	43100-84517	43100-84518
43130A #Z02	43100-84617	43100-84509	43100-84510	43100-84514	43100-84513	43100-84516	43100-84517	43100-84518
43130A #Z05	43100-84508	43100-84509	43100-84510	43100-84514	43100-84513	43100-84516	43100-84517	43100-84518

	GND SYM, VDE	CSA	INFO					
43130A								
43130A #C09								
43130A #L01	43100-84569							
43130A #L02	43100-84569							
43130A #L03	43100-84569							
43130A #L04	43100-84569							
43130A #L05	43100-84569							
43130A #L06	43100-84569							
43130A #N01		7120-6645	7121-2526					
43130A #N02	43100-84569							
43130A #N05	43100-84569							
43130A #Z01	43100-84569							
43130A #Z02	43100-84569							
43130A #Z05	43100-84569							

HEWLETT-PACKARD DEFIBRILLATORS

CASE PART NUMBERS
For HP 43130 Defibrillator

Model	Features	Case Part Numbers
HP 43130A	Attached power cord Serial Prefix <2601	Upper 43100-87110 Lower 43100-87100
	Detachable power cord Protective feet Serial prefix ≥2601	Upper 43100-87116 Lower 43100-87106
	Option #N02 Rear Power Switch	Upper 43100-87116 Lower 43100-87102